

**US ARMY ENGINEER SCHOOL
REPAIR VALVES
AND FIXTURE
CONTROL DEVICES
Plumbing V**

**THE ARMY INSTITUTE FOR PROFESSIONAL DEVELOPMENT
ARMY CORRESPONDENCE COURSE PROGRAM**



US ARMY PLUMBER

MOS 51K SKILL LEVELS 1 AND 2 COURSE

REPAIR VALVES AND FIXTURE CONTROL DEVICES PLUMBING V

SUBCOURSE NO. EN5114

**US Army Engineer School
Fort Leonard Wood, Missouri**

ELEVEN CREDIT HOURS

GENERAL

The Repair Valves and Fixture Control Devices subcourse, part of the MOS 51K Skill Levels 1 and 2 course, is designed to teach the knowledge required to repair valves and fixture control devices. The subcourse is presented in two lessons, each corresponding to a terminal objective as indicated below.

LESSON 1 MAINTENANCE OF VALVES

OBJECTIVE: Describe the procedures used to repair valves.

TASK: 051-248-1011, Repair valves and fixture control devices.

CONDITIONS: You will be given subcourse booklet EN5114 and an examination response sheet. You will work at your own pace and in your own selected environment without supervision.

STANDARDS: Within approximately 8 hours, you should be able to study the lesson resources, answer the review exercises, and select the correct response to each of the examination questions. You must respond correctly to 70 percent of the examination questions in order to receive credit for this subcourse.

LESSON 2

MAINTENANCE OF FIXTURE CONTROL DEVICES

OBJECTIVE: Describe the procedures used to repair fixture control devices.

TASK: 051-248-1011, Repair valves and fixture control devices.

CONDITIONS: You will be given subcourse booklet EN5114 and an examination response sheet. You will work at your own pace and in your own selected environment without supervision.

STANDARDS: Within approximately 3 hours, you should be able to study the lesson resources, answer the review exercises, and select the correct response to each of the examination questions. You must respond correctly to 70 percent of the examination questions in order to receive credit for this subcourse.

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STUDENT INQUIRY SHEET	
(Subcourse Content)	Following Examination

GRADING AND CERTIFICATION INSTRUCTIONS

Important: Electronic Examination Information

This paper subcourse does not contain the examination. The examination response sheet is included only as a mailing label. You must go to the following web site to complete the examination and submit it for grading.

http://www.aimsrdl.atsc.army.mil/accp/accp_top.htm

Registered students (those with ACCP userids and passwords) should key in the userid and password to LOGON, then click on the EXAM button to access the examination.

Students who have not yet registered should click on the REGISTER button on the lower right corner of the screen. Follow directions to create a userid and password. Then click on the EXAM button to access the examination.

INTRODUCTION

Valves and fixture control devices control the flow of water into, through, and out of the plumbing system. Knowledge of the repair of valves and fixture control devices is a necessity. In order to repair valves and fixture control devices, a plumber must be familiar with their construction and operation. A close inspection of any valve or fixture control device consists of examining for visible leaks, wear, and breakage. You may be required to partially or completely disassemble a mechanism to make a repair.

Lesson 1 MAINTENANCE OF VALVES

Objective

At the end of this lesson, you will be able to describe the procedures to repair valves.

Task

051-248-1011, Repair valves and fixture control devices.

Conditions

You will be given subcourse booklet EN5114 and an examination response sheet. You will work at your own pace and in your own selected environment without supervision.

Standards

Within approximately 8 hours, you should be able to study the lesson resources, answer the review exercises, and select the correct response to each examination question. You must respond correctly to 70 percent of the examination questions in order to receive credit for this subcourse.

Credit Hours

8

References

FM 5-51K 1/2

TM 5-551K

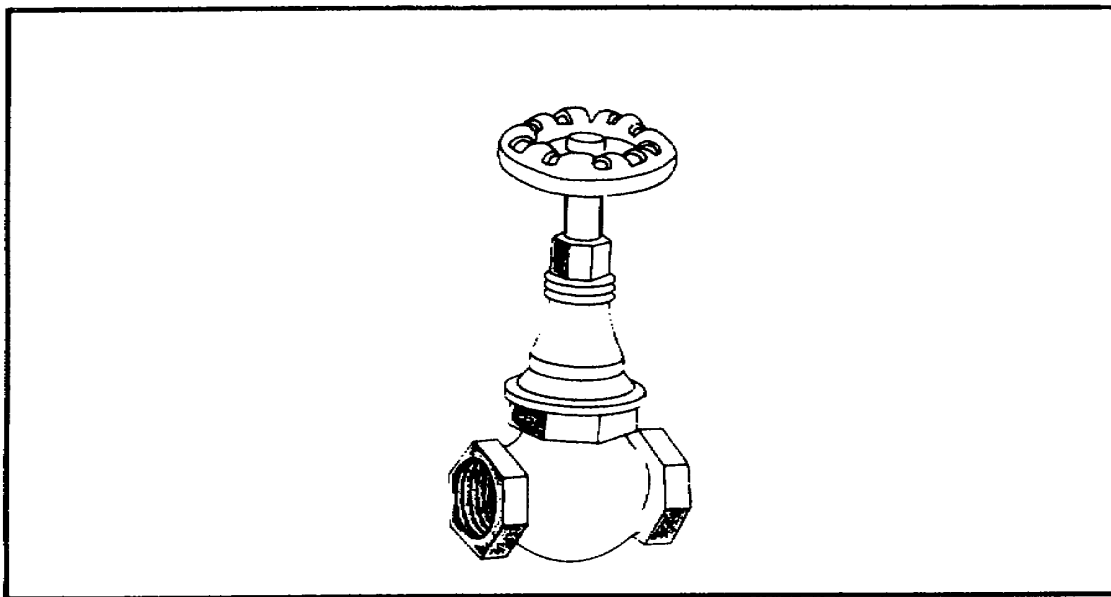
Learning Event 1: IDENTIFYING VALVES

Valves come in many types, shapes, and sizes for a building's water plumbing system. The most common types used in a water pipeline system are gate, globe, and check valves. Plumbing fixtures also require valves such as flushometers and faucets. When a valve leaks or fails to operate properly, it has to be repaired. The repair may require a partial or complete disassembly of the valve. A repaired valve must restore the valve to a totally serviceable operating condition.

Lesson 1/Learning Event 1

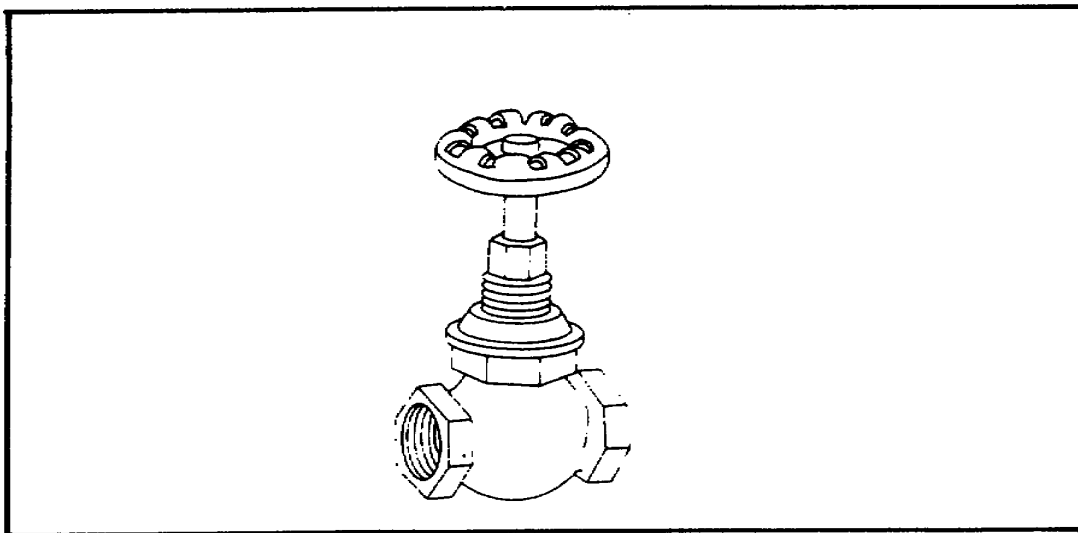
Pipeline Valves. Valves used in water pipelines are illustrated here. A gate valve completely shuts off the flow of water (figure 1).

FIGURE 1. GATE VALVE



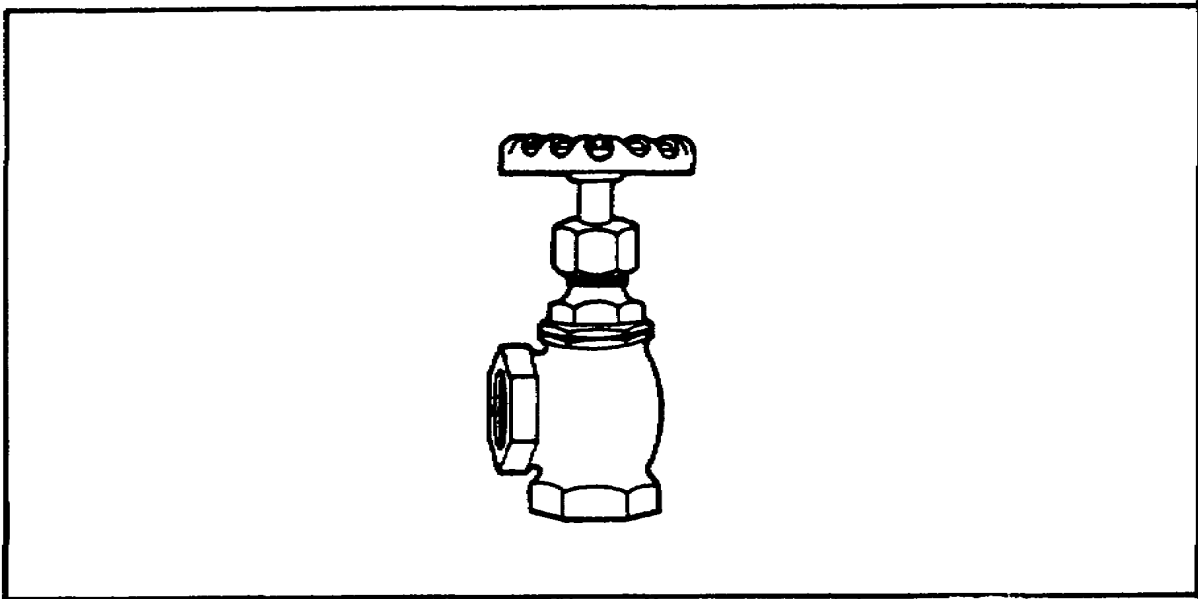
A globe valve regulates or controls the flow of water (figure 2).

FIGURE 2. GLOBE VALVE



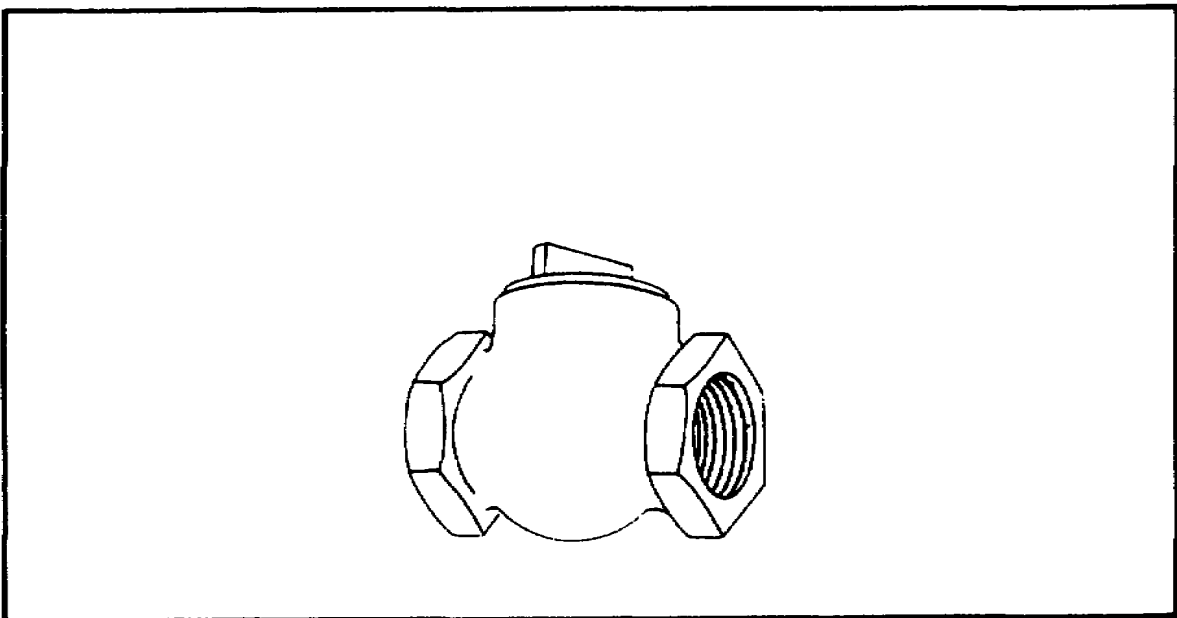
An angled globe valve regulates or controls and changes the direction of the flow of water (figure 3).

FIGURE 3. ANGLED GLOBE VALVE



A check valve makes water flow in one direction only, then closes automatically to prevent backflow (figure 4).

FIGURE 4. SWING CHECK VALVE

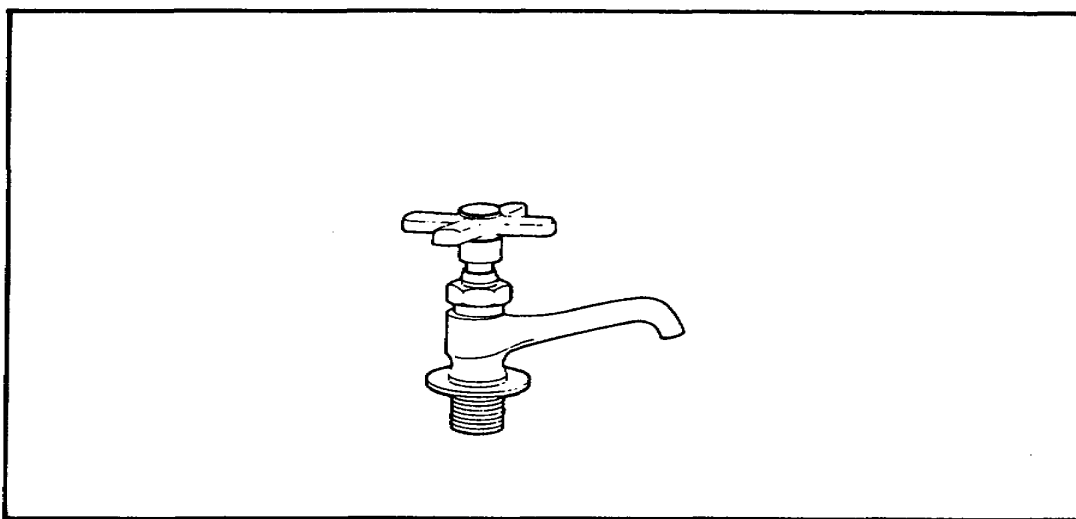


Lesson 1/Learning Event 1

Faucets. Valves (faucets) used for plumbing fixtures, such as lavatories and sinks, are illustrated in figures 5 through 8 on pages 4 and 5.

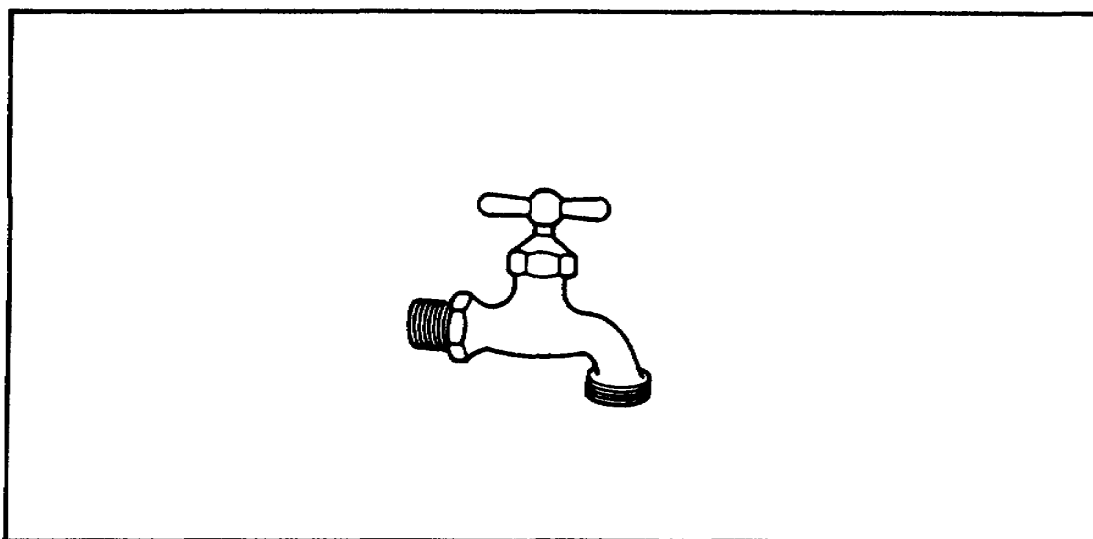
A single faucet with plain bibb turns hot or cold water flow on and off (figure 5).

FIGURE 5. SINGLE FAUCET WITH PLAIN BIBB



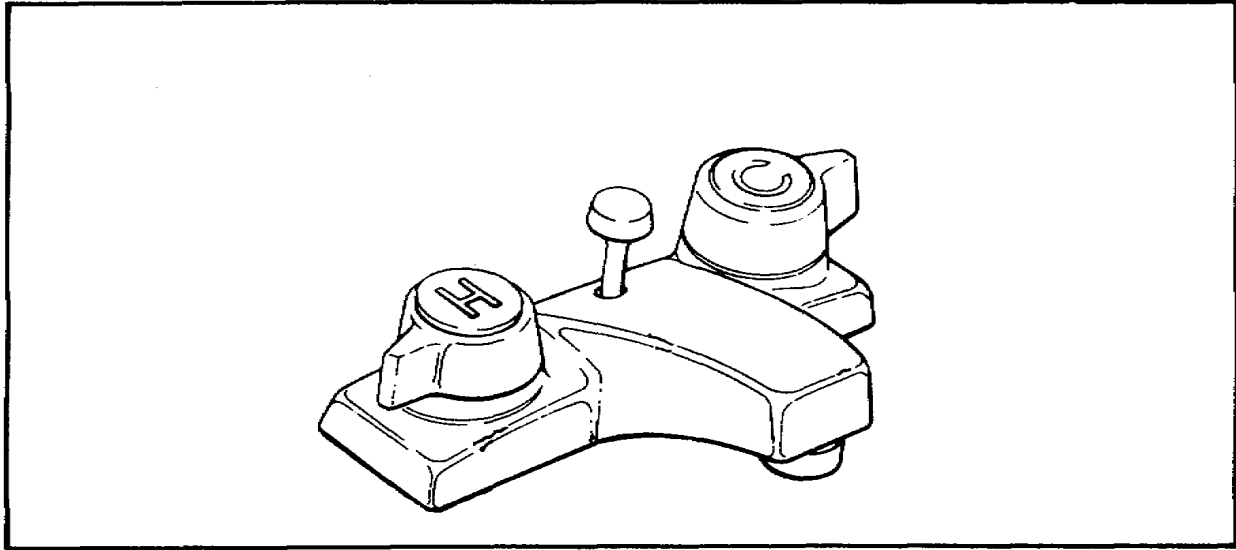
A single faucet with hose bibb turns hot or cold water flow on and off (figure 6).

FIGURE 6. SINGLE FAUCET WITH HOSE BIBB



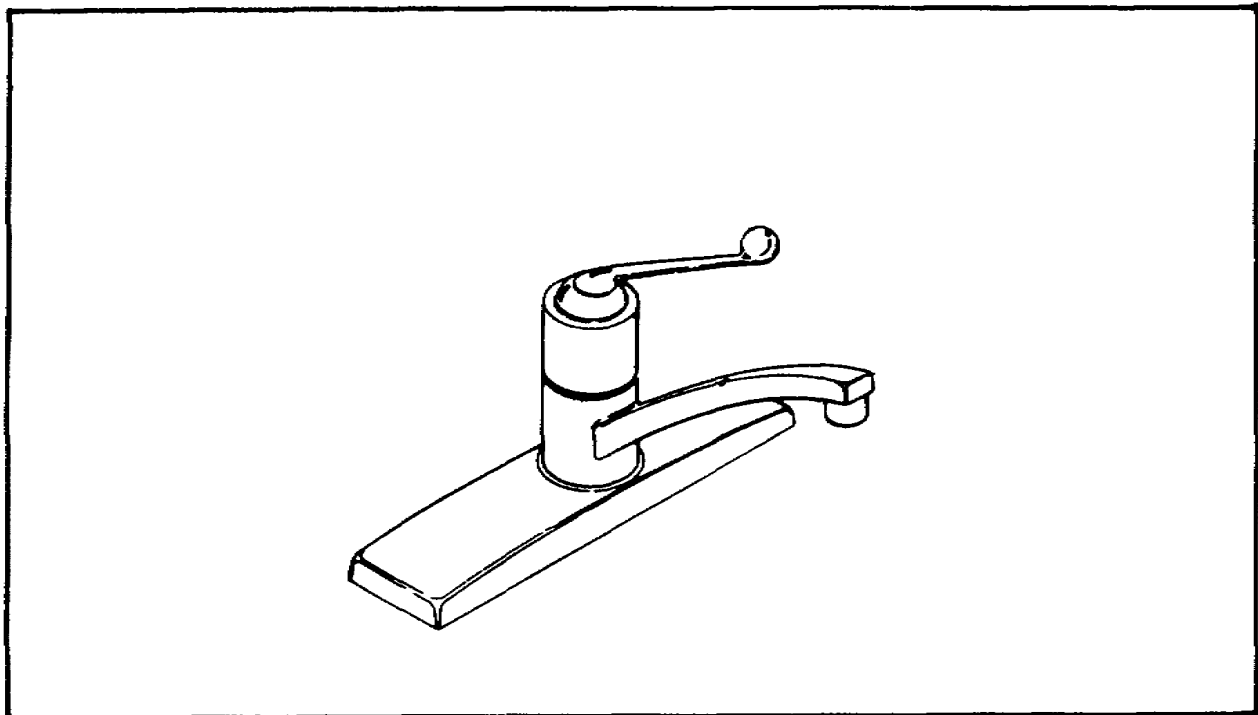
A combination faucet with hot and cold water handles turns water flow on and off (figure 7).

FIGURE 7. COMBINATION FAUCET WITH HANDLES



A combination faucet with a single lever turns hot and cold water flow on and off (figure 8).

FIGURE 8. COMBINATION FAUCET WITH LEVER



Lesson 1/Learning Event 1

Flushometers. Flushometer valves used for plumbing fixtures such as water closets and urinals are illustrated in figures 9 and 10. Both types of flushometer valves, diaphragm and piston, discharge a fixed amount of water for flushing fixtures. The amount is activated by direct water pressure.

FIGURE 9. DIAPHRAGM FLUSHOMETER VALVE

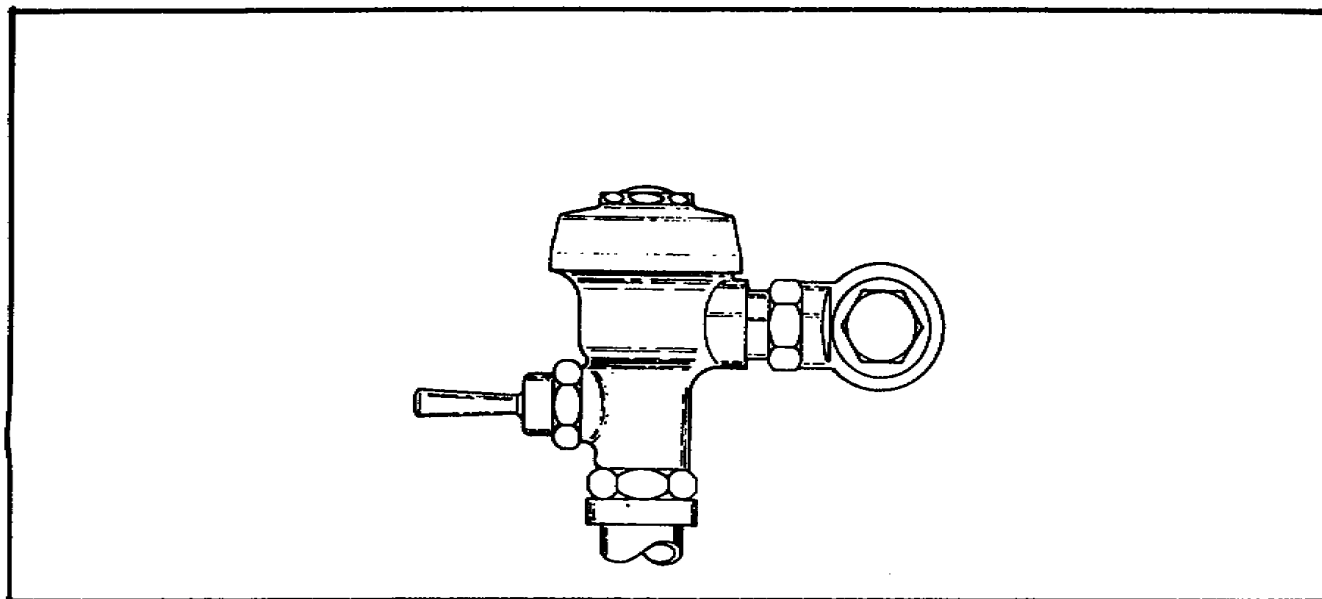
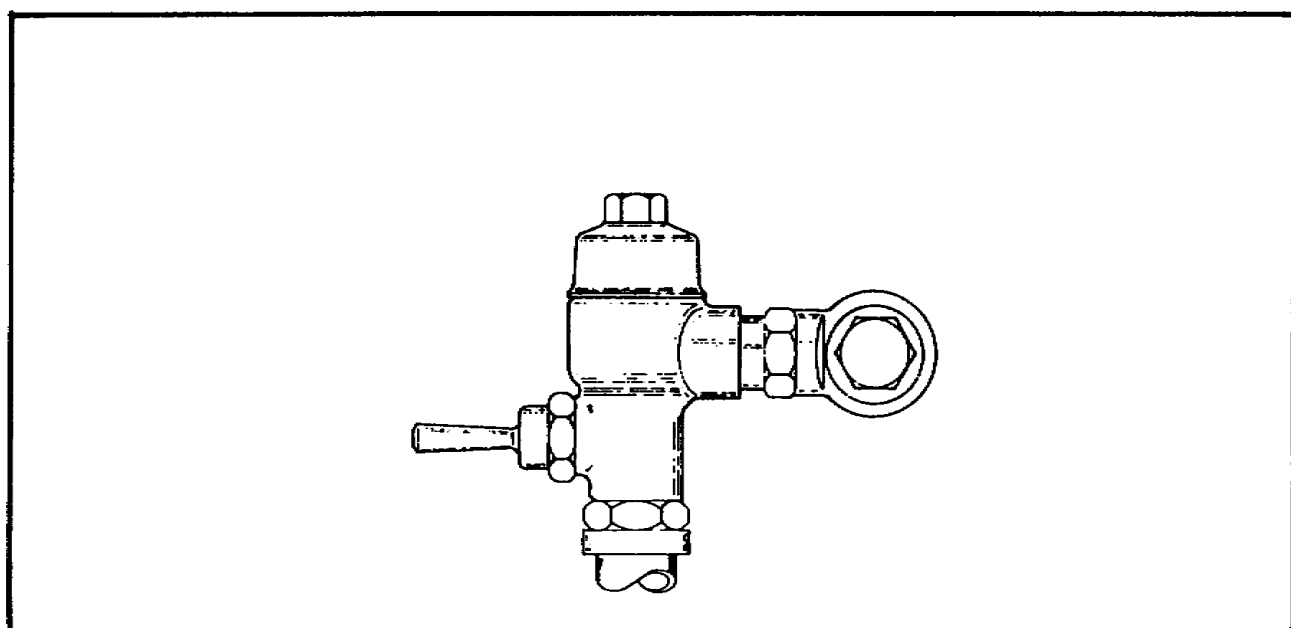


FIGURE 10. PISTON FLUSHOMETER VALVE



SELF-CHECK EXERCISE

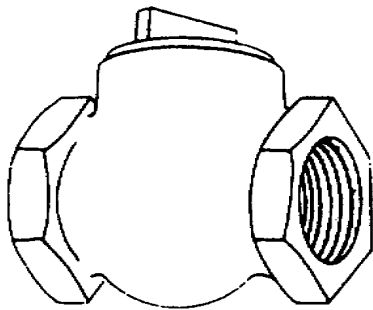
Solutions to this exercise are on page 10.

1. Identify each valve correctly using the choices provided. Write your answer in the blanks.

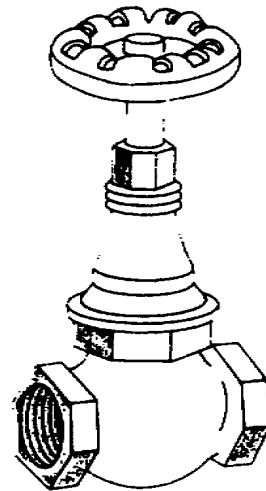
Gate valve

Angled globe valve

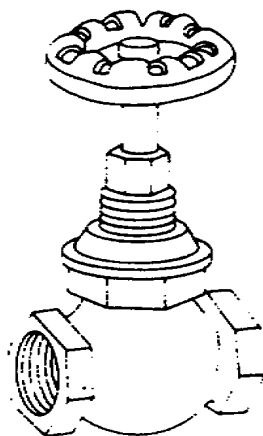
Swing check valve



A _____



B _____



C _____

Lesson 1/Learning Event 1

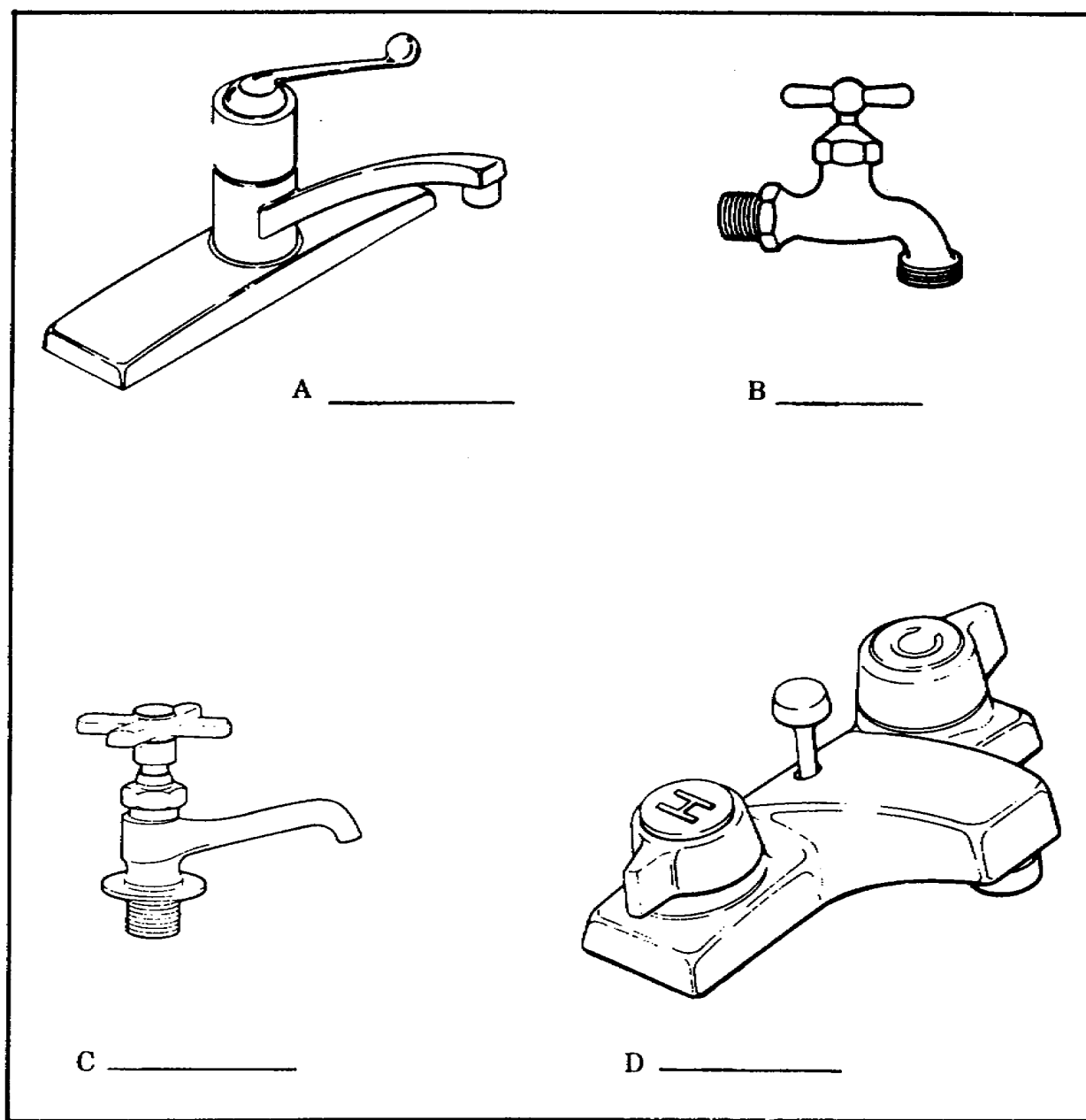
2. Identify each faucet correctly using the choices provided. Write your answer in the blanks.

Single faucet with hose bibb

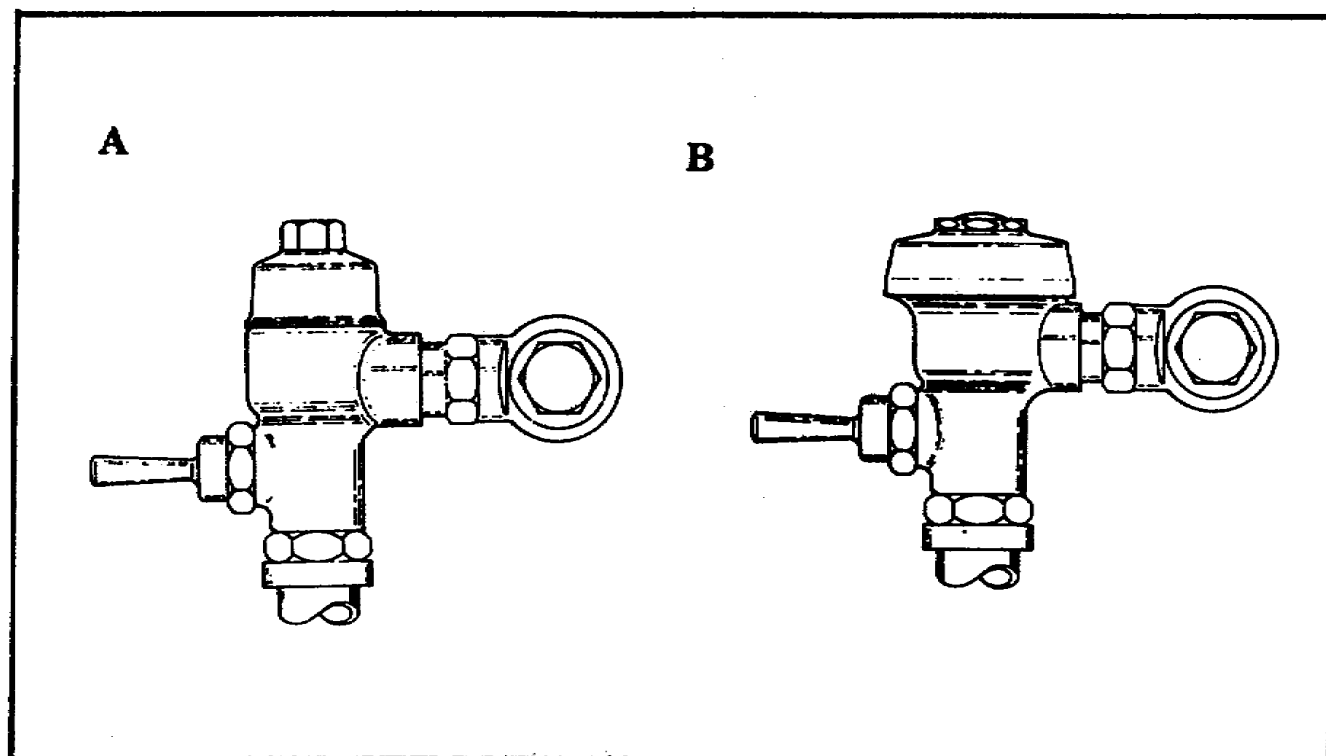
Combination faucet with a single lever

Combination faucet with hot and cold water faucets

Single faucet with plain bibb



3. Look at the illustration. Which flushometer valve is the piston type? The piston type is

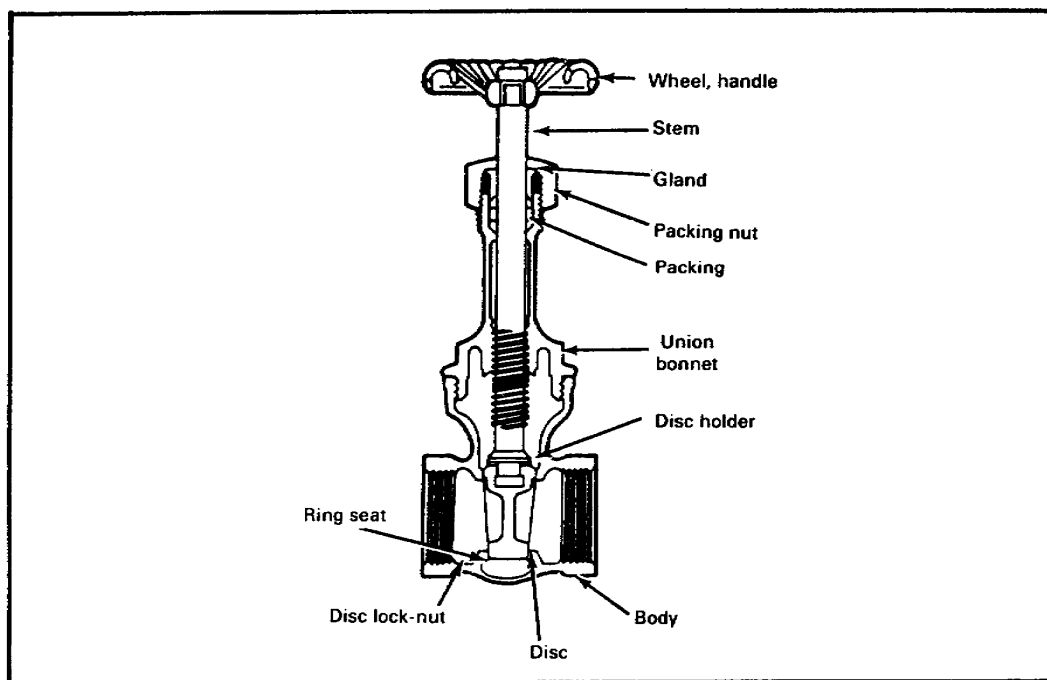


Lesson 1/Learning Event 2

Learning Event 2: REPAIRING VALVES

Gate, globe, and check valves should be inspected periodically for leaks and proper operation. If a leak is found or the valve operates improperly, the problem is located. A repair is made to restore the valve to a serviceable operating condition. See figures 11 through 13 on pages 10 through 13.

FIGURE 11. CROSS SECTION OF GATE VALVE



SELF-CHECK EXERCISE SOLUTIONS

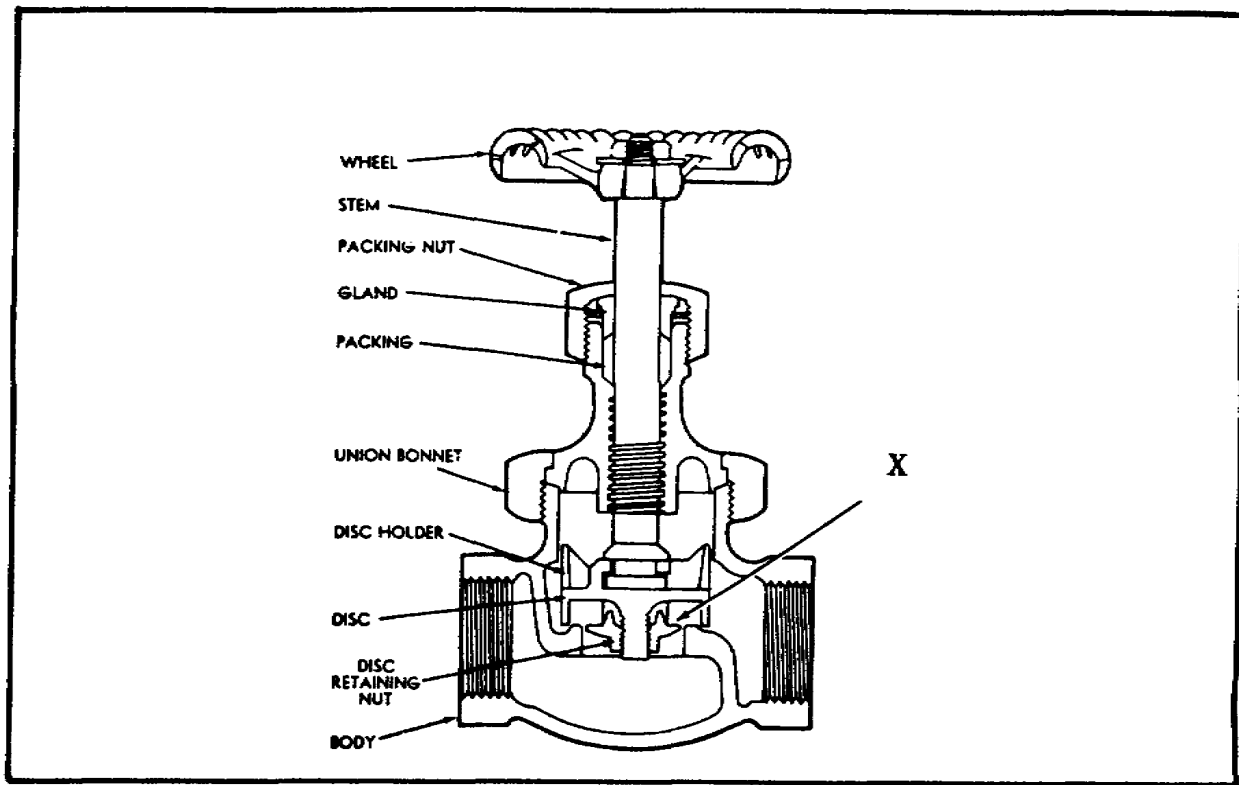
1. VALVES
 - A. Swing check valve
 - B. Gate valve
 - C. Angled globe valve
2. FAUCETS
 - A. Combination faucet with a single lever
 - B. Single faucet with hose bibb
 - C. Single faucet with plain bibb
 - D. Combination faucet with hot and cold water handles
3. The piston type is A.

GATE VALVE MALFUNCTIONS AND REPAIRS

Malfunction	Repairs
1. Leak at stem and packing nut.	<p>Tighten packing nut.</p> <p>If leak continues—</p> <ol style="list-style-type: none"> a. Turn off water supply. b. Then remove wheel handle. c. Set in new packing. d. Replace packing nut and wheel handle. e. Turn water on and check for leaks.
2. Valve will not close properly to stop water flow.	<ol style="list-style-type: none"> a. Turn off water supply, then disassembly to valve from the wheel handle to the body. b. Resurface disc with a mixture of oil and lapping compound. c. Reassemble the valve. d. Turn on water supply and check valve for proper operation and leaks. <p>Note: Since the valves are completely disassembled, other parts may be needed for reassembly.</p>
3. Malfunction unknown in valve	<ol style="list-style-type: none"> a. Turn off water supply, then disassemble the valve until the problem is located. b. Replace faulty parts and reassemble the valve. c. Turn on water supply and check valve for proper operation and leaks.

NOTE: If the valve cannot be repaired, replace it.

FIGURE 12. CROSS SECTION OF GLOBE VALVE



GLOBE VALVE MALFUNCTIONS AND REPAIRS

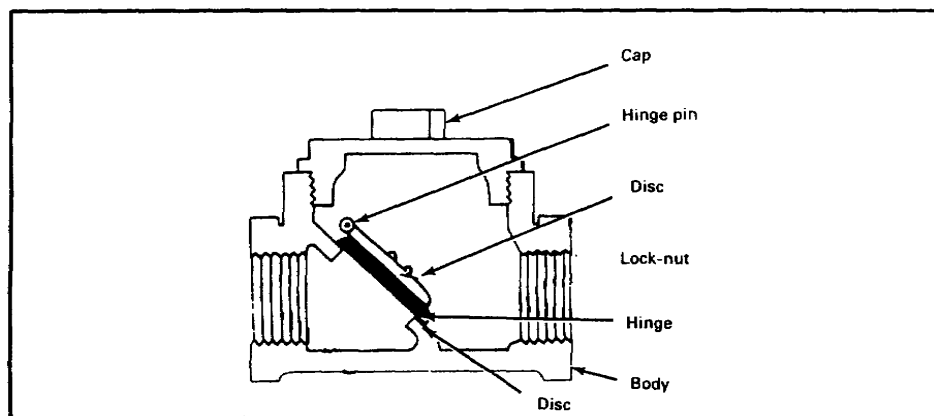
Malfunction	Repairs
1. Leak at stem and packing. Tighten packing nut.	<p>If leak continues—</p> <ol style="list-style-type: none"> Turn off water supply. Then remove wheel handle. Set in new packing. Replace packing nut and wheel handle. Turn water on and check for leaks.
2. Valve will not regulate or control the amount of water flow when—	<ol style="list-style-type: none"> Turn off water supply. Disassemble valve from handle to the body. Remove old disc and replace it with a new one. Reassemble the valve.
a. Composition disc type is used.	

GLOBE VALVE MALFUNCTIONS AND REPAIRS (Continued)

- | | |
|--|--|
| | e. Turn on the water supply and check valves for proper operation and leaks. |
| b. Plug type or conventional disc is used. | a. Turn off water supply. |
| | b. Disassemble valve from handle to the body. |
| | c. Remove the disc. |
| | d. Insert a washer under it and then lap the disc to the seat for a snug fit. |
| | e. Reassemble valve, turn on water supply, and check valve for proper operation and leaks. |
| 3. Malfunction unknown in valve | a. Turn off water supply, then disassemble the valve until malfunction is located. |
| | b. Replace faulty part and reassemble the valve. |
| | c. Turn on water supply and check valve for proper operation and leaks. |

NOTE: If valve cannot be repaired, replace it.

FIGURE 13. CROSS SECTION OF SWING CHECK VALVE



SWING CHECK VALVE MALFUNCTIONS AND REPAIRS

- | Malfunction | Repairs |
|---|--|
| 1. Loose disc lock nut causing water back flow. | a. Turn water supply off, then remove cap. |

Lesson 1 /Learning Event 2

SWING CHECK VALVE MALFUNCTIONS AND REPAIRS (Continued)

- | | |
|---|--|
| | <ul style="list-style-type: none">b. Tighten lock nutc. Replace cap and turn on water supply.d. Check valve for proper operation and leaks. |
| 2. Hinge not closing completely due to wear. | <ul style="list-style-type: none">a. Turn water supply off, then remove cap.b. Replace hinge pin or hinge with hinge pin.c. Replace cap and turn on water supply.d. Check valve for proper operation and leaks. |
| 3. Worn disc face. | <ul style="list-style-type: none">a. Turn water supply off, then remove cap.b. Remove the lock nut and then the disc.c. Attach new disc to hinge and tighten lock nut.d. Replace cap and turn on water supply.e. Check valve for proper operation and leaks. |

NOTE: If valve cannot be repaired, replace it.

SELF-CHECK EXERCISE

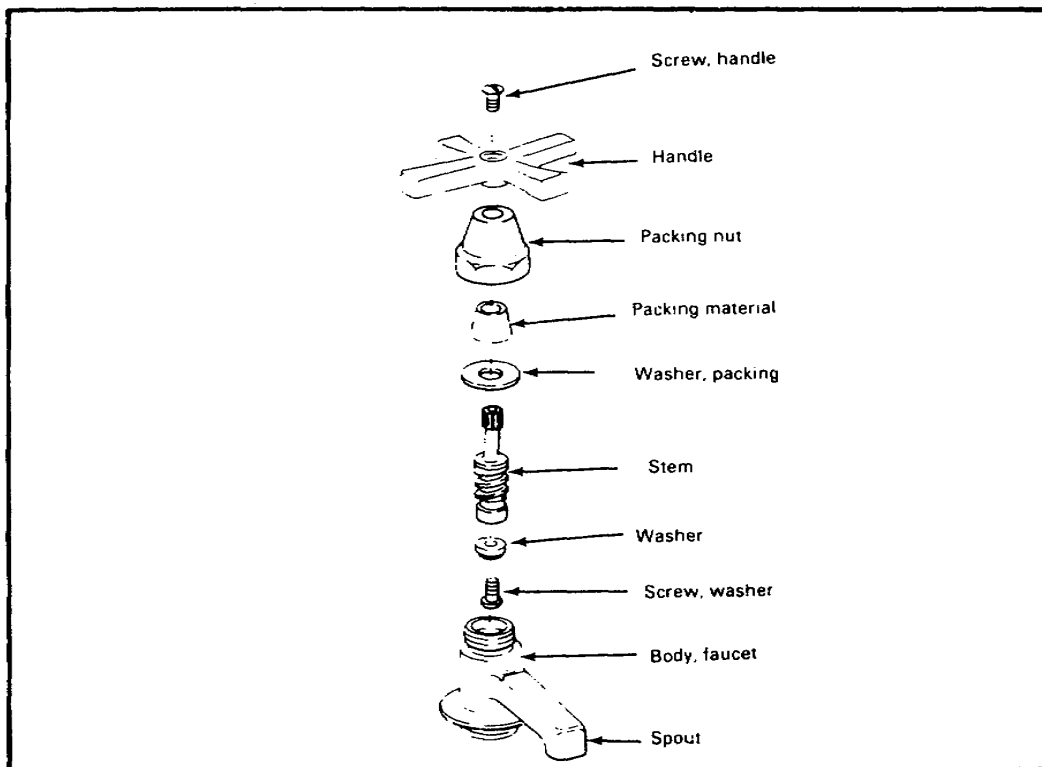
Fill in the blanks with your responses. Solutions are on page 16.

1. A leak at the stem and packing nut is repaired by replacing the _____.
2. The disc in a gate valve can be repaired using a mixture of oil and lapping compound to _____ the disc.
3. A composition type disc in a globe valve can be repaired by _____ it.
4. A plug or conventional type disc in a globe valve can be repaired by inserting a _____ and lapping the disc to the seat.
5. A swing check valve's hinge pin or hinge with hinge pin is repaired when not completely _____.
6. A swing check valve's worn disc can be repaired by _____ it.

Learning Event 3: REPAIRING FAUCETS

Faucets on lavatories/sinks are valves that receive a great deal of use, resulting in leaks or failures over a period of time through wear and tear. When this happens, the malfunction of the faucet is determined and repaired. The repair must restore the faucet to a serviceable, operating condition. See figures 14 through 16 on pages 15 through 19.

FIGURE 14. SINGLE FAUCET PARTS



SINGLE FAUCET MALFUNCTIONS AND REPAIRS

Malfunction	Repairs
1. Leak at stem and packing nut.	a. Turn off water supply with shutoff valve. b. Remove cap, screw, and handle. c. Remove packing nut with a wrench. d. Remove old packing material and washer.

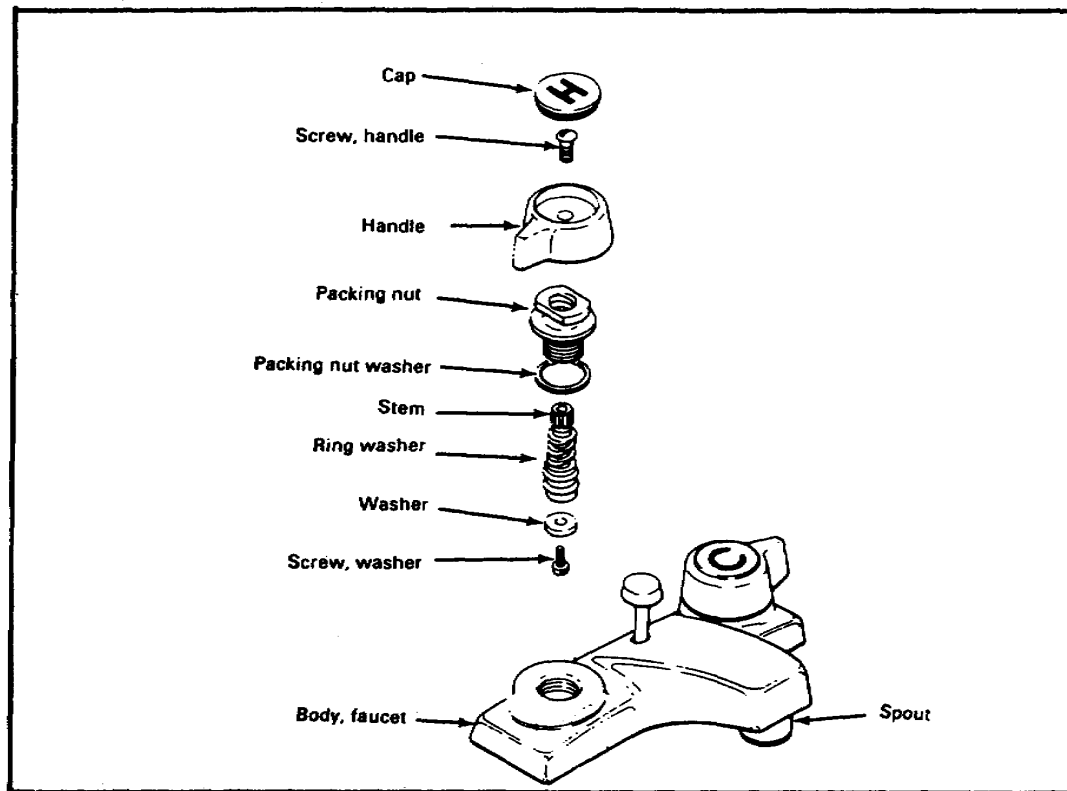
SINGLE FAUCET MALFUNCTIONS AND REPAIRS (Continued)

- e. Place new washer and packing material on stem.
 - f. Screw packing nut onto the body of the faucet hand tight, then tighten with wrench.
 - g. Replace handle, screw, and cap.
 - h. Turn on water supply to check for leaks and faucet operation.
- 2. Leak at spout.
 - a. Turn off water supply with shutoff valve.
 - b. Disassemble faucet down to the body and remove the stem.
 - c. Remove screw and washer from bottom of stem.
 - d. Place a new washer into the bottom of the stem and secure to stem with new screw.
 - e. Check valve seat inside of body. If it is chipped or rough, replace seat with a repacking tool. If seat is OK, place stem onto body.
 - f. Reassemble valve and turn on water supply.
 - g. Check for leaks and faucet operation.

SELF-CHECK EXERCISE SOLUTIONS

1. Packing
2. Resurface
3. Replacing
4. Washer
5. Closing
6. Replacing

FIGURE 15. COMBINATION FAUCET PARTS



COMBINATION FAUCET MALFUNCTIONS AND REPAIRS

Malfunction

1. Leak at top of stem.

Repairs

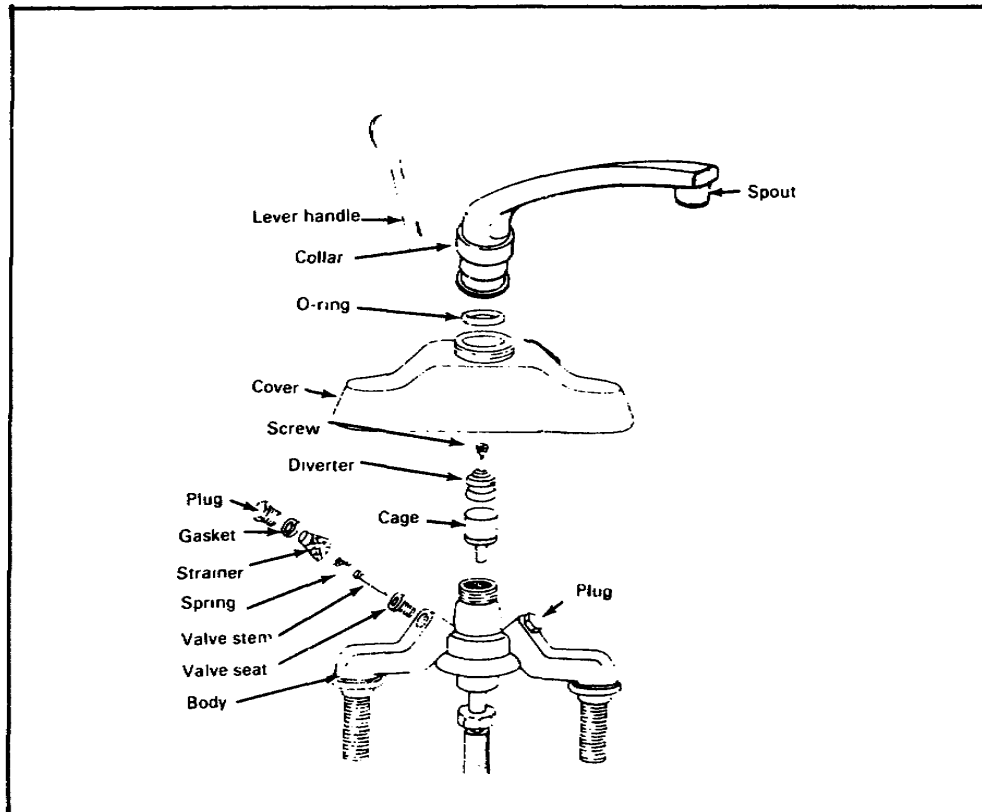
- a. Turn off water supply at shutoff valve.
- b. Remove cap, screw, and handle.
- c. Remove packing nut with a wrench.
- d. Remove stem from body.
- e. Remove worn washer by sliding it off the lower end of the stem.
- f. Slide a new washer onto the stem's lower end.
- g. Reassemble all parts in their proper order.
- h. Turn on water supply to check for leaks and proper faucet operation.

**COMBINATION FAUCET MALFUNCTIONS AND REPAIRS
(Continued)**

- 2. Leak at spout.**
 - a. Turn off water supply at shutoff valve.**
 - b. Remove cap, screw, and handle.**
 - c. Remove packing nut with a wrench.**
 - d. Remove stem from body.**
 - e. Remove screw and worn washer from the bottom of the stem.**
 - f. Place a new washer into the bottom of the stem and secure to stem with a new screw.**
 - g. Check valve seat inside of body. If it is chipped or rough, reface seat with a refacing tool. If seat is OK, place stem into body.**
 - h. Reassemble all parts in their proper order.**
 - i. Turn on water supply and check for leaks and proper faucet operation.**

- 3. Leak at base of body.**
 - a. Turn off water supply at shutoff valve.**
 - b. Remove cap, screw, and handle.**
 - c. Remove packing nut with wrench.**
 - d. Remove worn washer from packing nut.**
 - e. Slide a new washer onto packing nut for a snug fit.**
 - f. Reassemble all parts in their proper order.**
 - g. Turn on water supply and check for leaks and proper faucet operation.**

FIGURE 16. SINGLE LEVER COMBINATION FAUCET PARTS



**SINGLE LEVER COMBINATION FAUCET,
VALVE-TYPE, MALFUNCTIONS, AND REPAIRS**

Malfunction

1. Leak at spout.

Repairs

- a. Turn off hot and cold water supply at shutoff valves.
- b. Unscrew the collar and lift spout off.
- c. Remove lever from rear of body.
- d. Remove worn O-ring and install a new O-ring at the base of the spout.
- e. Reassemble spout by tightening collar.
- f. Turn on water supply and check for leaks.

**SINGLE LEVER COMBINATION FAUCET, VALVE-TYPE,
MALFUNCTIONS AND REPAIRS (Continued)**

- 2. Malfunction unknown.**
- a. Turn off hot and cold water supply at shutoff valves.**
 - b. Unscrew the collar and lift off spout.**
 - c. Remove cover.**
 - d. Remove plug and disassemble each part until faulty part or parts are located.**
 - e. Replace faulty part or parts.**
 - f. Reassemble faucet.**
 - g. Turn on water supply and check for leaks and proper faucet operation.**

NOTE: There are three types of washerless faucets: valve, ball, and cartridge. Each type has different internal working parts. Use manufacturer's instructions for all repairs.

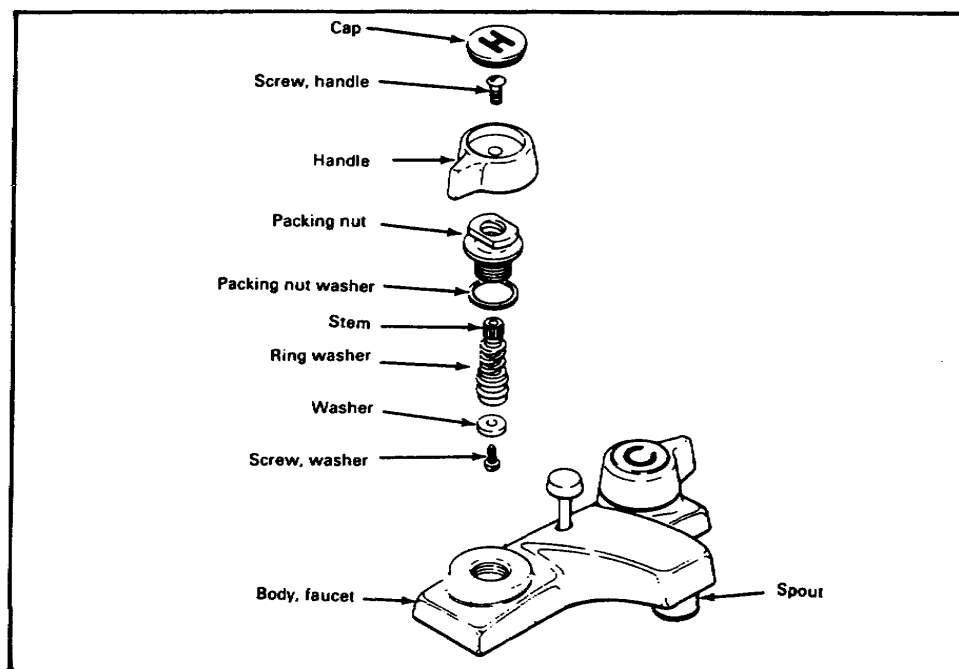
Lesson 1/Learning Event 3

SELF-CHECK EXERCISE

Fill in the blanks with your responses. Answers are on page 23.

1. A single faucet is leaking at the stem and packing nut To repair the leak, you replace the _____.
2. A single faucet is leaking at the spout To repair the leak, you replace the _____ at the bottom of the stem.

For questions 3 and 4 use the illustration below.



3. The combination faucet is leaking at the top of the stem. Which part would you replace?
4. The combination faucet is leaking at the base of the body. Which part would you replace?
5. A single lever combination faucet, valve type, is leaking at the spout. Which part would you replace?

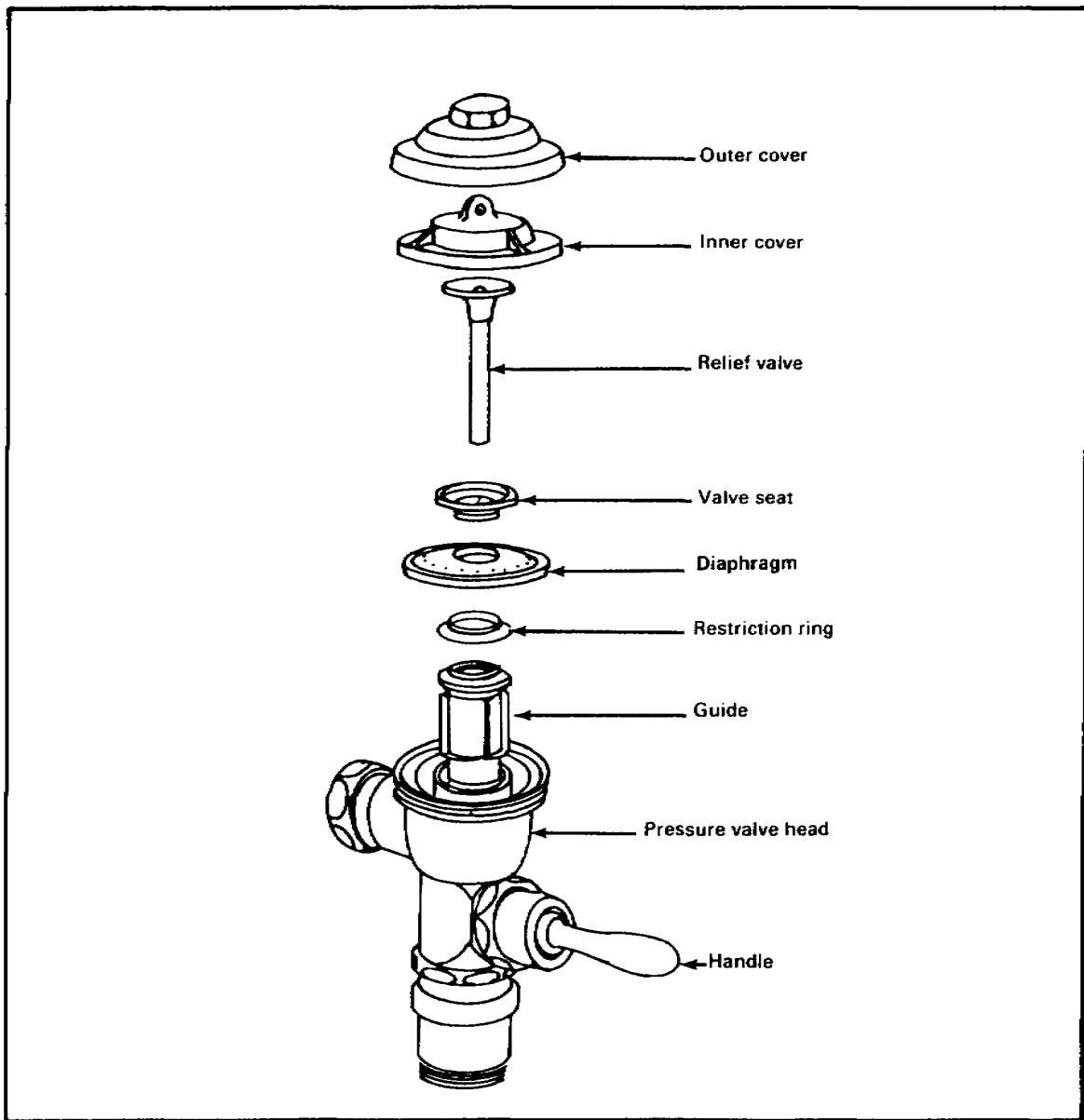
- A. Diverter
- B. O-ring
- C. Plug
- D. Valve seat

Lesson 1/Learning Event 4

Learning Event 4: REPAIRING FLUSHOMETER VALVES

Flushometer valves on water closets and urinals are automatic flushing valves. Over a period of time, a malfunction inside the valve or handle assembly can occur. When this happens, the malfunction is located and repaired. See figures 17 through 19 on pages 22 through 25.

FIGURE 17. DIAPHRAGM FLUSHOMETER PARTS



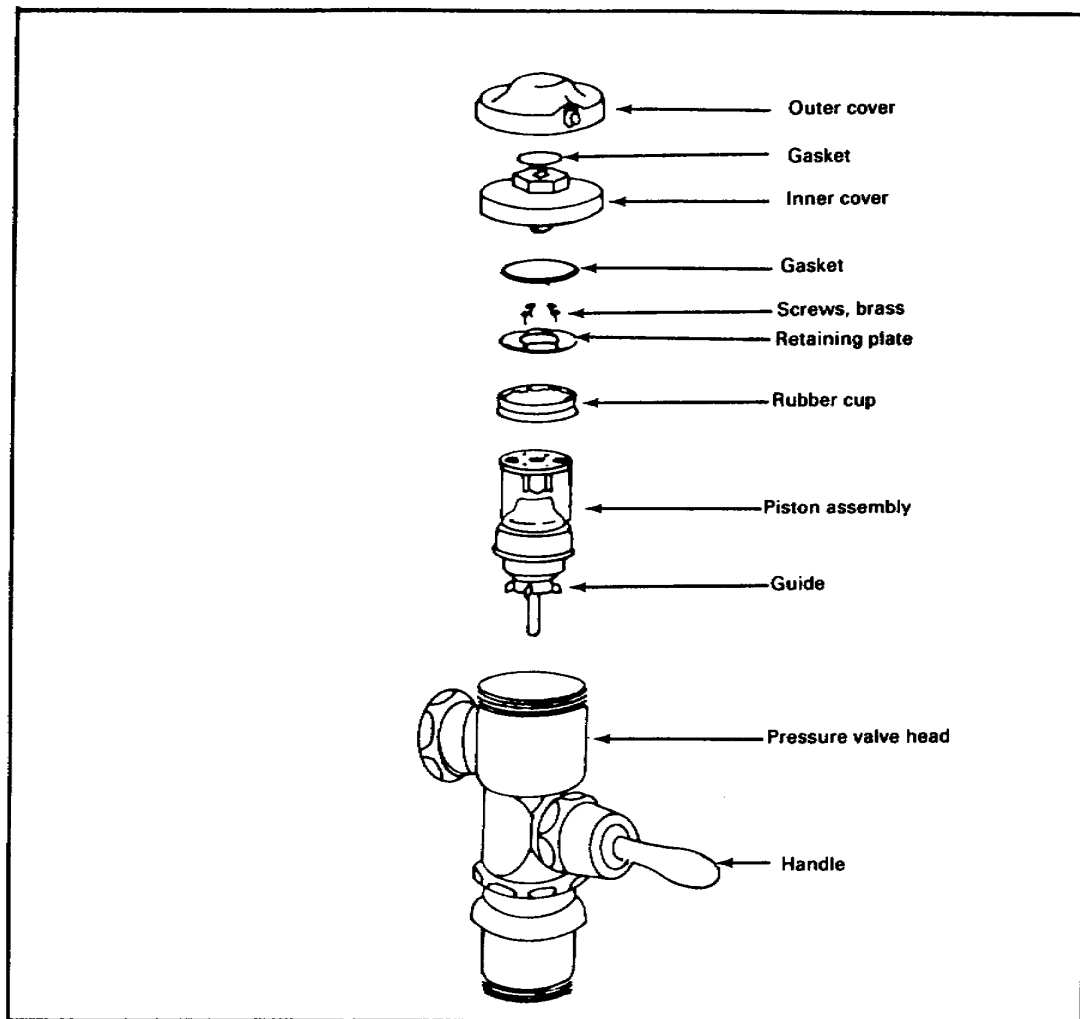
**DIAPHRAGM-TYPE FLUSHOMETER VALVE
MALFUNCTIONS AND REPAIRS**

Malfunction	Repairs
Not flushing or will not stop flushing.	<ul style="list-style-type: none">a. Turn off water supply.b. Remove outer cover with wrench.c. Remove inner cover. If cover will not come off, pry off with a screwdriver.d. Remove relief valve.e. Remove valve seat.f. Remove clogged or worn diaphragm.g. Install new diaphragm.h. Reassemble the valve.i. Turn on water supply.j. Check valve operation.

SELF-CHECK EXERCISE SOLUTIONS

1. Packing material
2. Washer
3. C
4. B
5. B

FIGURE 18. PISTON FLUSHOMETER PARTS

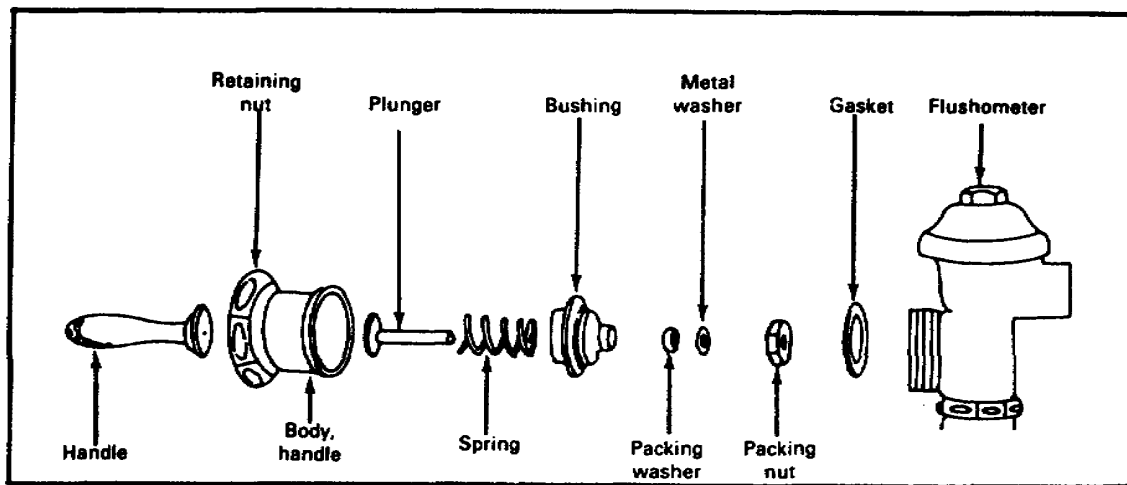


**PISTON-TYPE FLUSHOMETER VALVE
MALFUNCTIONS AND REPAIRS**

Malfunction	Repairs
Not flushing or will not stop flushing.	a. Turn off water supply. b. Remove outer cover and gasket. c. Remove inner cover and gasket. d. With a screwdriver, remove brass screws and remove retaining plate.

- e. Remove clogged or worn rubber cup.
- f. Install new rubber cup.
- g. Reassemble the valve.
- h. Turn on water supply.
- i. Check valve operation.

FIGURE 19. FLUSHOMETER HANDLE PARTS



FLUSHOMETER VALVE HANDLE MALFUNCTIONS AND REPAIRS

Malfunction	Repairs
1. Water leak at handle.	<ol style="list-style-type: none"> a. Turn off water supply. b. Unscrew retaining nut. c. Pull out the handle body which contains all parts up to the packing nuts. d. Grip the handle body with a wrench and with another wrench unscrew the packing nut. e. Remove the worn packing washer. f. Install a new packing washer. g. Reassemble all parts. h. Turn on water supply. i. Check handle for leaks and proper operation.

**FLUSHOMETER VALVE HANDLE MALFUNCTIONS AND
REPAIRS (Continued)**

2. Loose and wobbly handle. a. Turn off water supply.

b. Unscrew retaining nut.

**NOTE: Can also cause
leak at the handle.**

**c. Pull out handle body which contains
all parts up to the packing nut.**

**d. Grip the handle body with a wrench
and with another wrench unscrew the
packing nut.**

**e. Grip the handle body with a wrench
and unscrew the bushing with lock-
grip pliers.**

**f. Remove worn bushing, spring, or
plunger.**

**g. Replace worn part or parts with new
ones.**

h. Reassemble all parts.

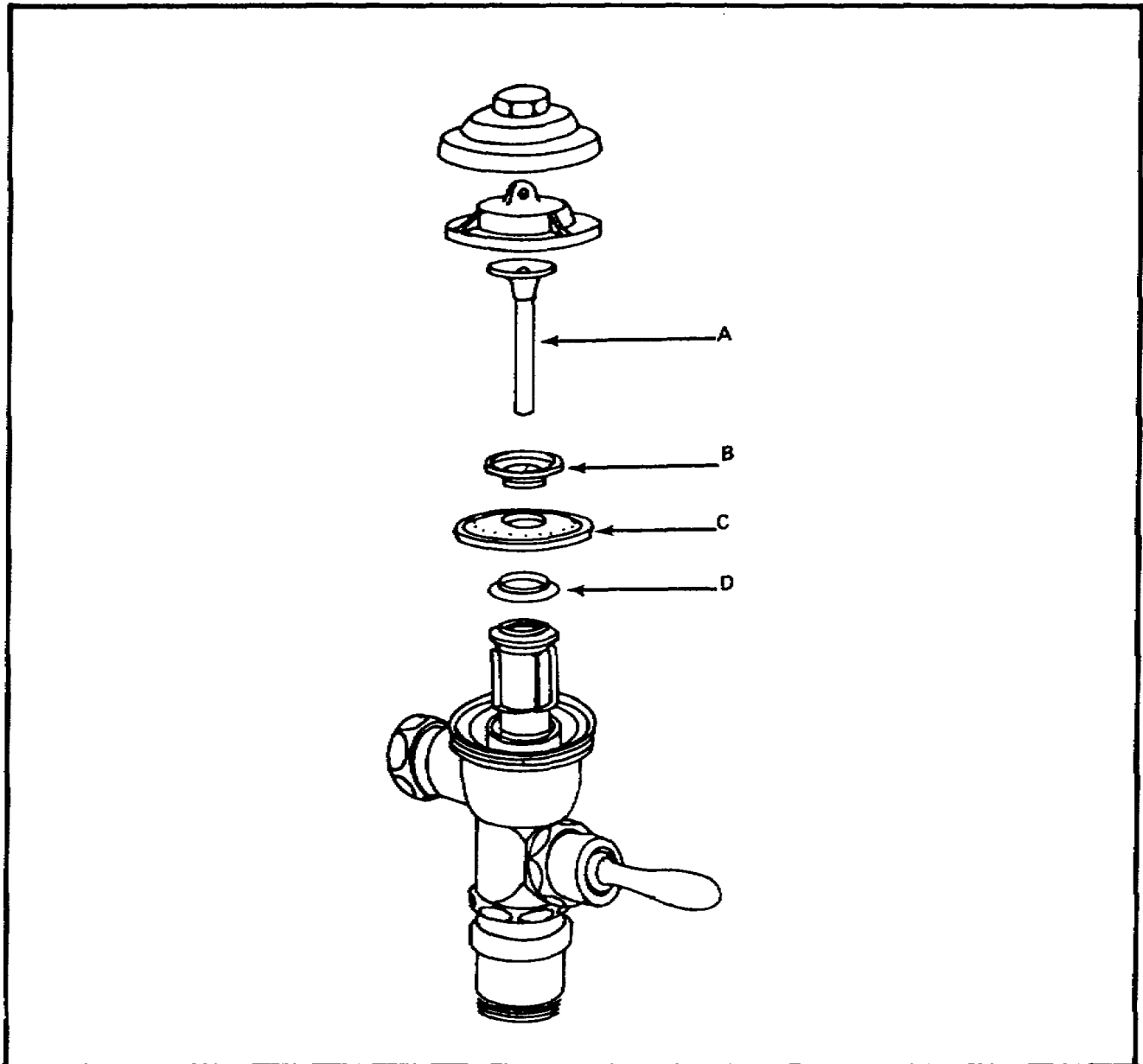
i. Turn on water supply.

**j. Check handle for leaks and proper
operation.**

SELF-CHECK EXERCISE

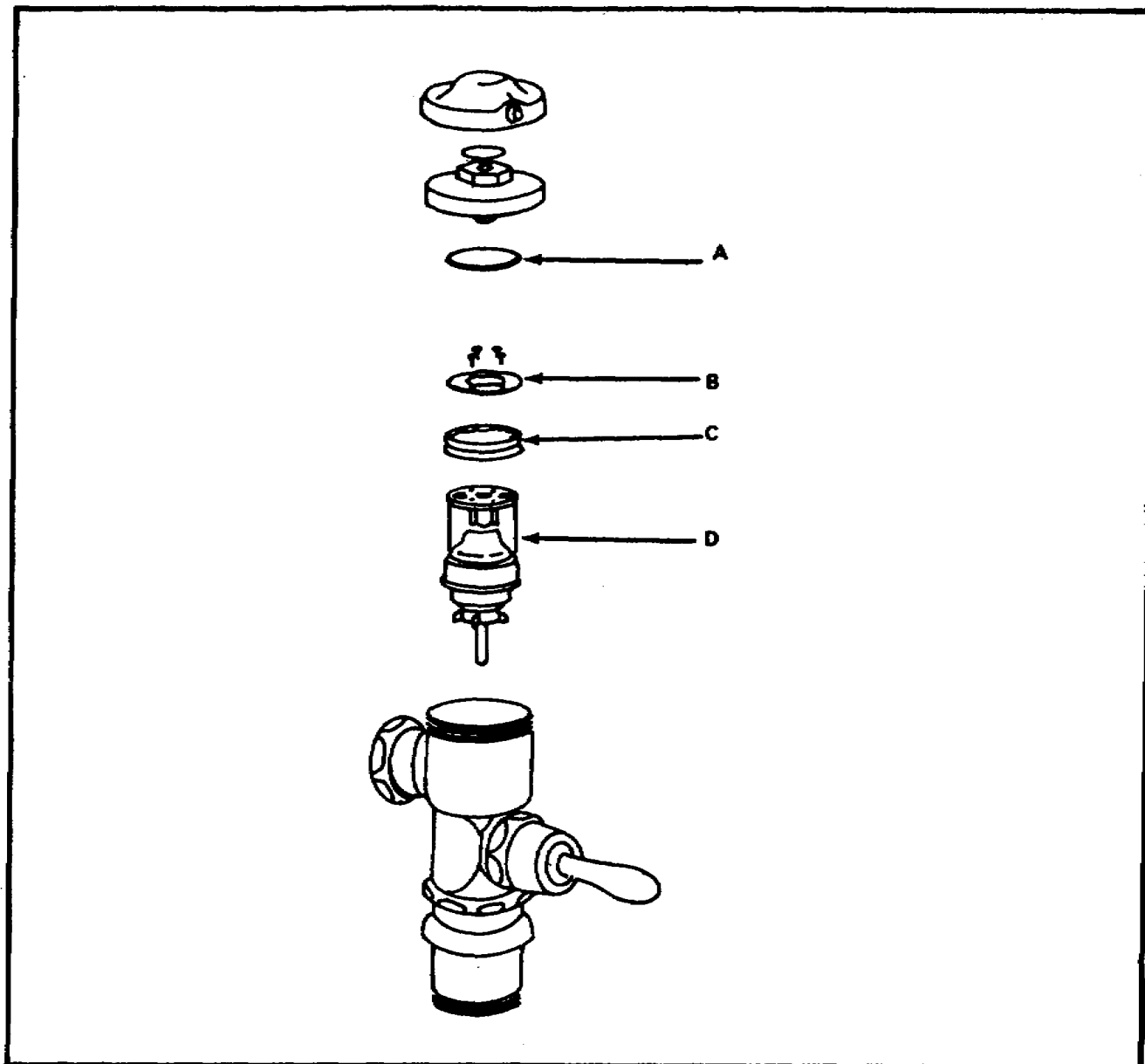
Solutions are on page 30.

1. What part would you replace if the flushometer will not stop flushing?
(See illustration.)

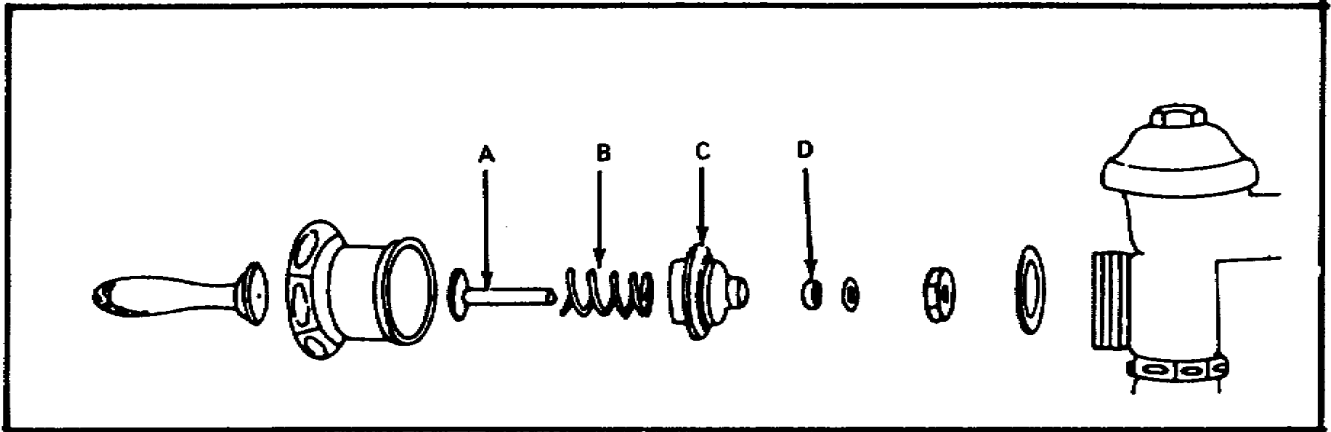


Lesson 1/Review Exercise

2. What part would you replace if the flushometer does not flush? (See illustration.)



3. What part would you replace if the handle is firm but has a water leak? (See illustration.)



Lesson 1/Review Exercise

Lesson 1

REVIEW EXERCISE

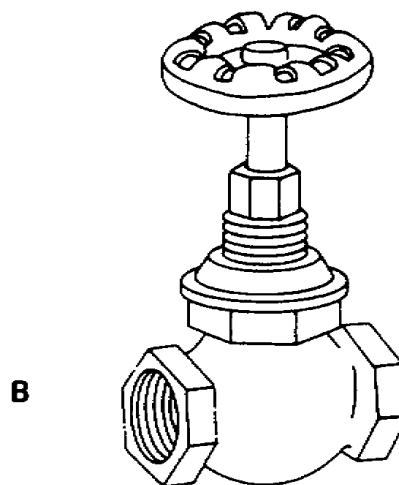
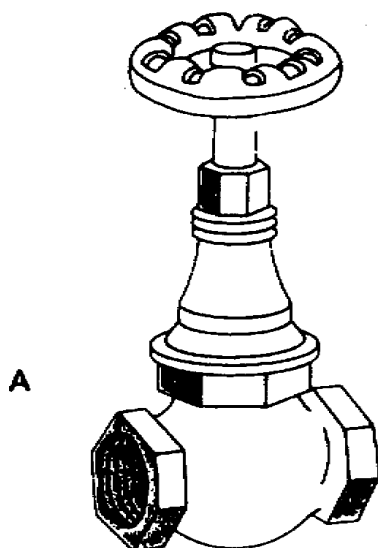
Check your understanding of Lesson by completing these review exercises. Try to complete all of the exercises without looking back at the lesson. When you are finished, turn to the solutions at the end of the lesson and check your responses. If you missed any, go back and restudy the place in the lesson where the information is given. Fill in blanks with your responses.

Solutions are on page 38.

1. Identify each type of valve by name.

A. _____

B. _____



2. A gate valve is used to _____ the flow of water.

3. A globe valve is used to _____ the flow of water.

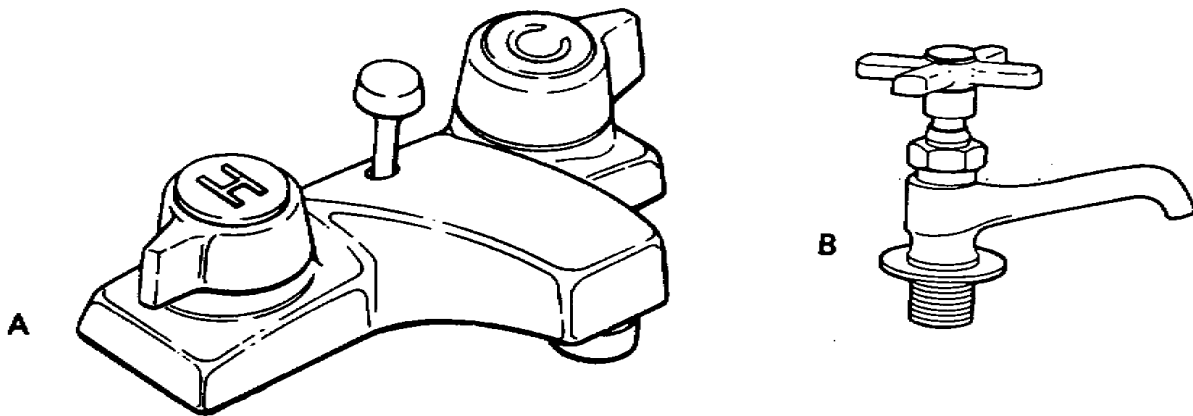
SELF-CHECK EXERCISE SOLUTIONS

1. C. Diaphragm
2. C. Rubber cup
3. D. Packing washer

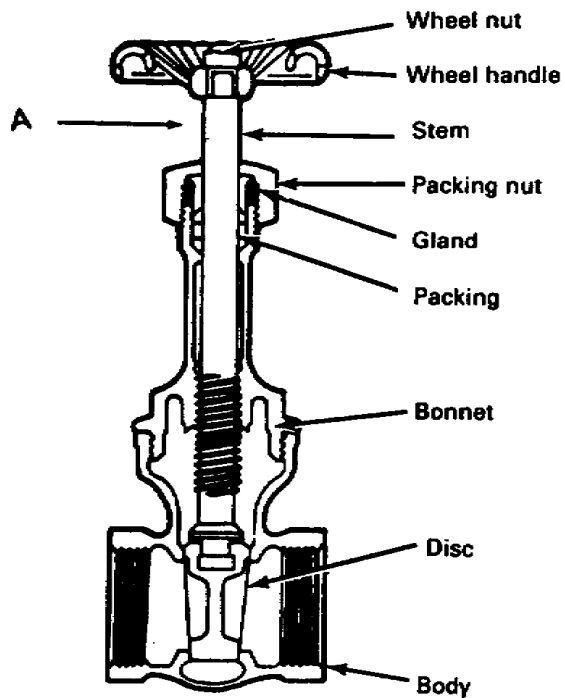
4. Identify each type of faucet by name.

A. _____

B. _____

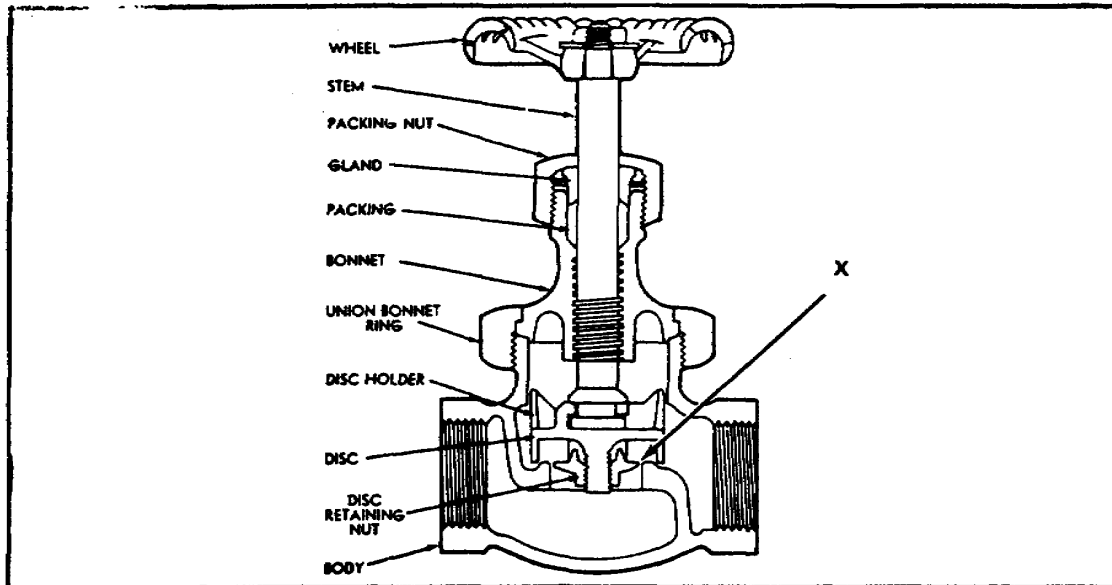


5. The gate valve is leaking at point A. What part requires replacement to stop the leak? _____.

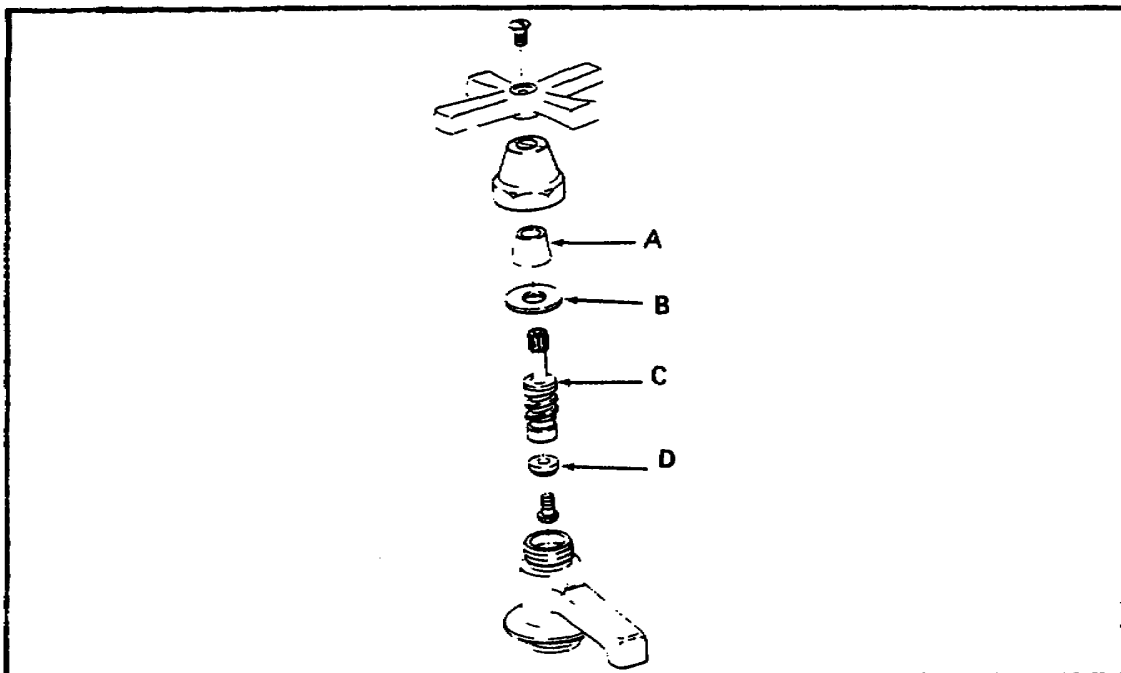


Lesson 1/Review Exercise

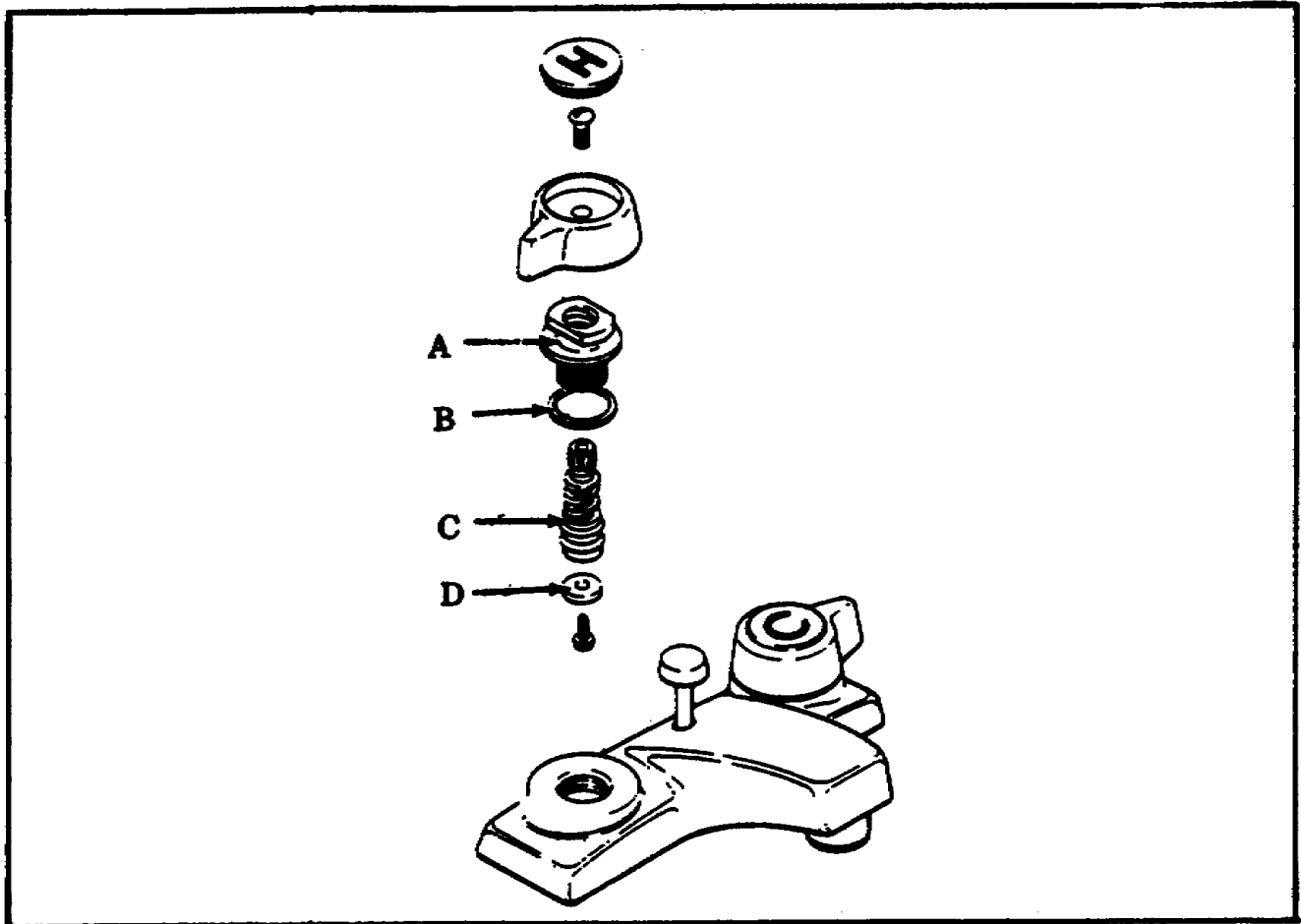
6. The globe valve is leaking at point X. What part requires replacement to stop the leak?
- _____.



7. The single faucet, plain bibb, is leaking at the stem. What part requires replacement?
- _____.

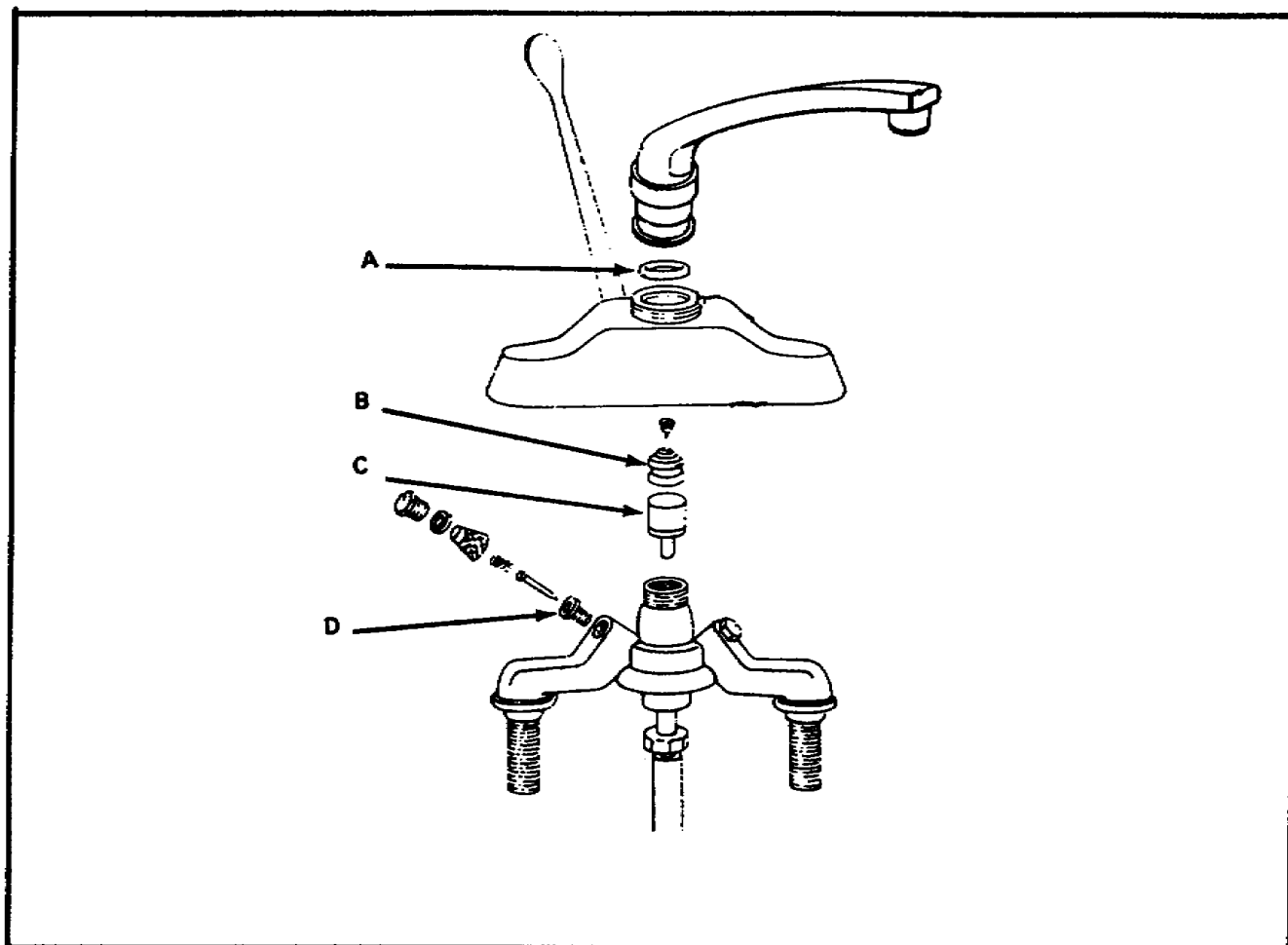


8. The combination faucet is leaking at the base of the body. What part requires replacement?

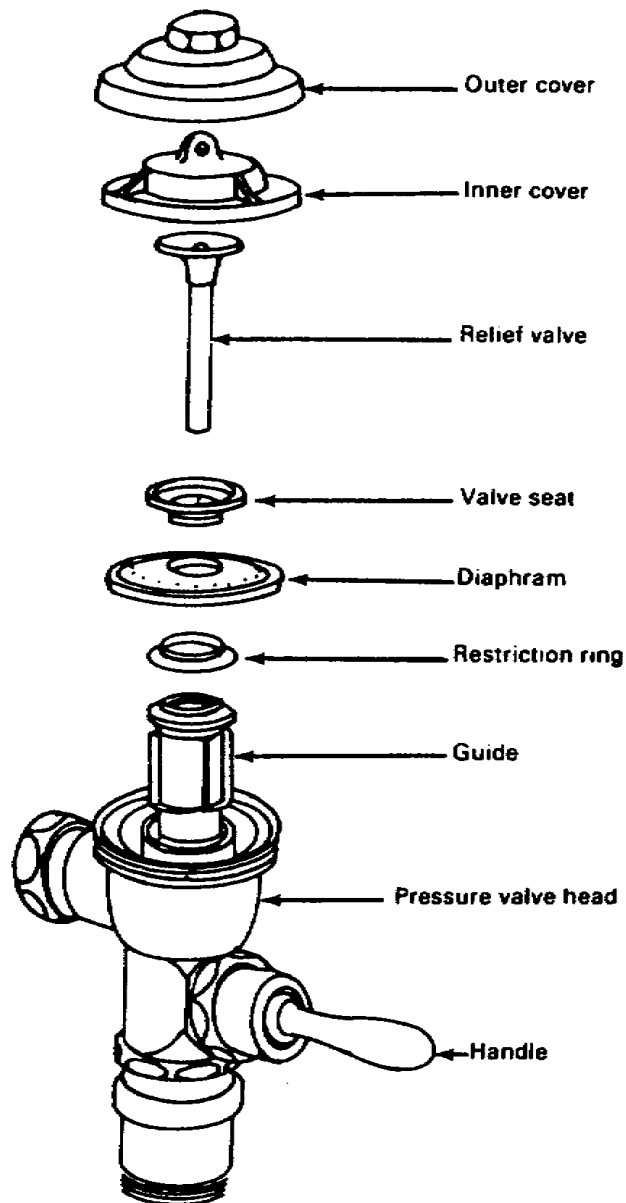


Lesson 1/Review Exercise

9. The single lever combination faucet valve type, is leaking at the spout. What part requires replacement? _____.

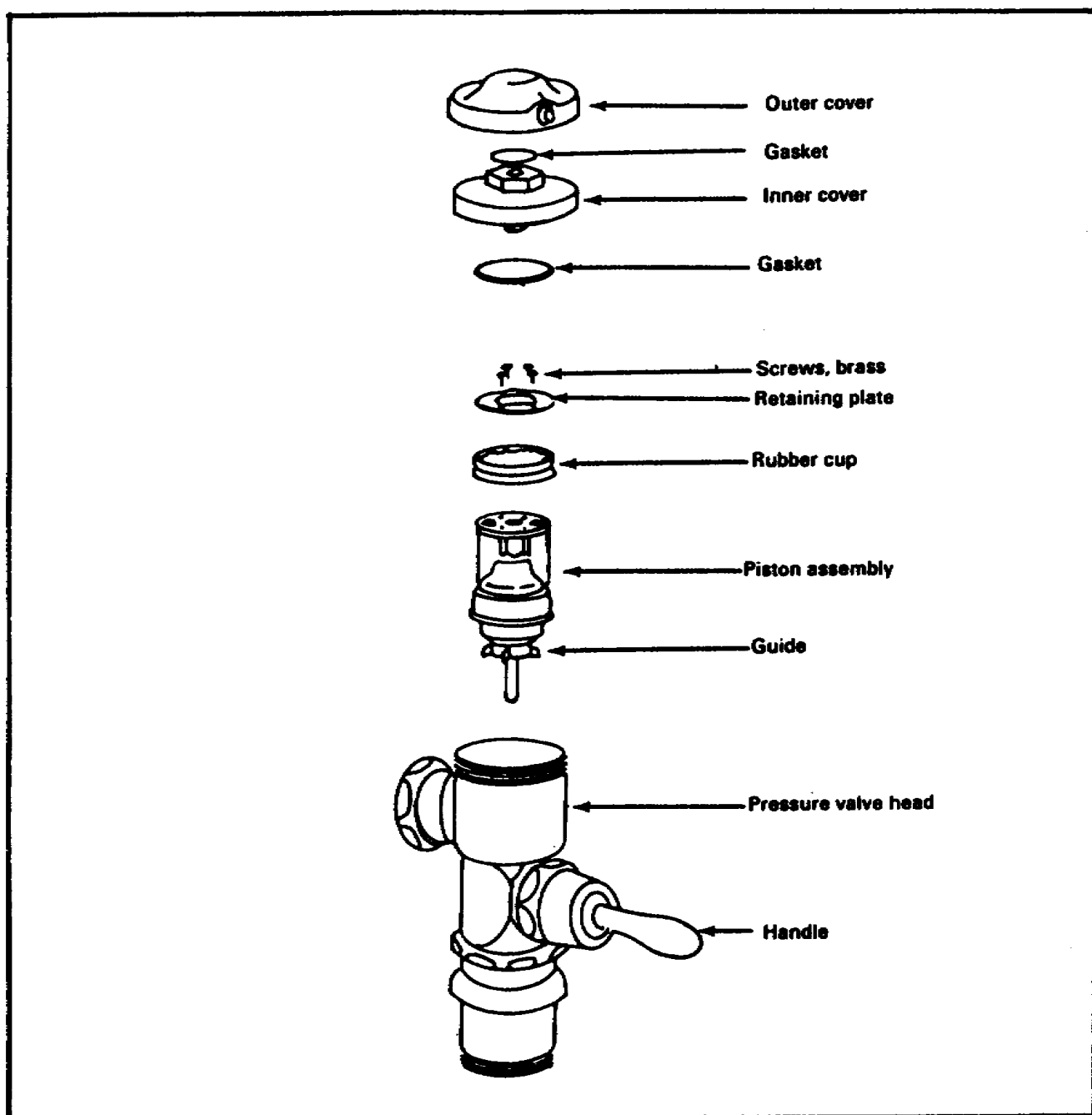


10. The diaphragm type flushometer valve will not flush a water close. What part requires replacement? _____.

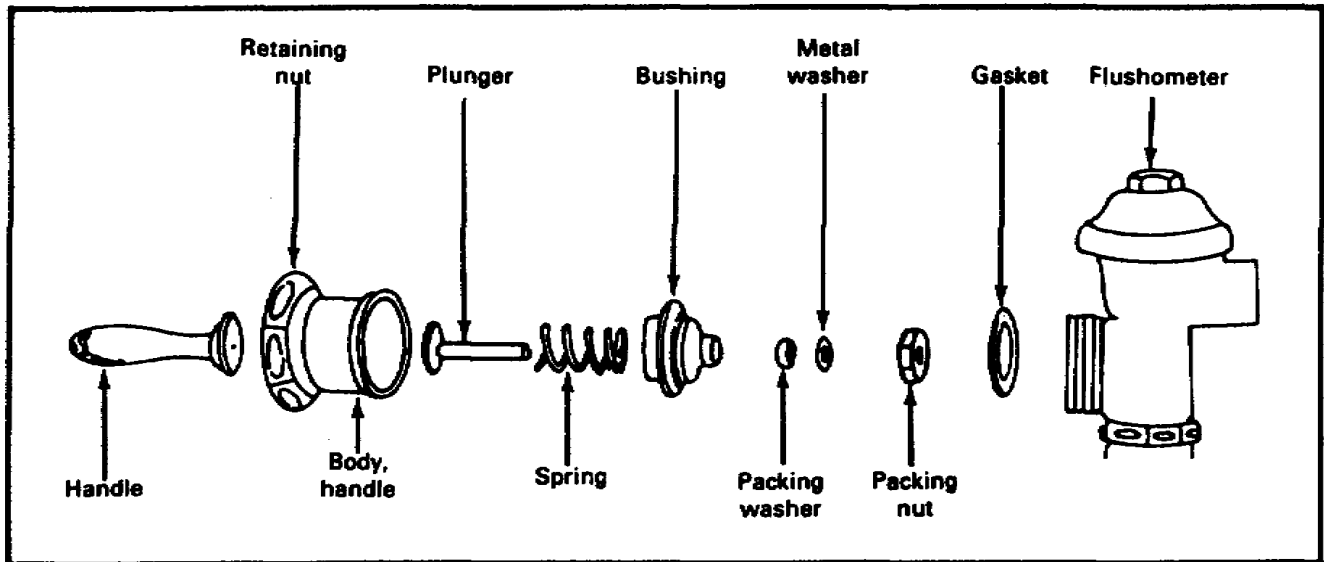


Lesson 1/Review Exercise

11. The piston type flushometer valve will not stop flushing a urinal. What part requires replacement?



12. The diaphragm type flushometer for a water closet is leaking at the handle. What part requires replacement? _____.



Lesson 2/Learning Event 1

Lesson 2 MAINTENANCE OF FIXTURE CONTROL DEVICES

Objective

At the end of this lesson, you will be able to describe the procedures used to repair fixture control devices.

Task

051-248-1011, Repair valves and fixture control devices.

Condition

You will be given subcourse booklet EN5114 and an examination response sheet. You will work at your own pace and in your own selected environment without supervision.

Standards

Within approximately 3 hours, you should be able to study the lesson resources, answer the review exercises, and select the correct response for each examination question. You must respond correctly to 70 percent of the examination questions in order to receive credit for this subcourse.

Credit Hours

3

References

FM 5-51K 1/2

TM 5-551K

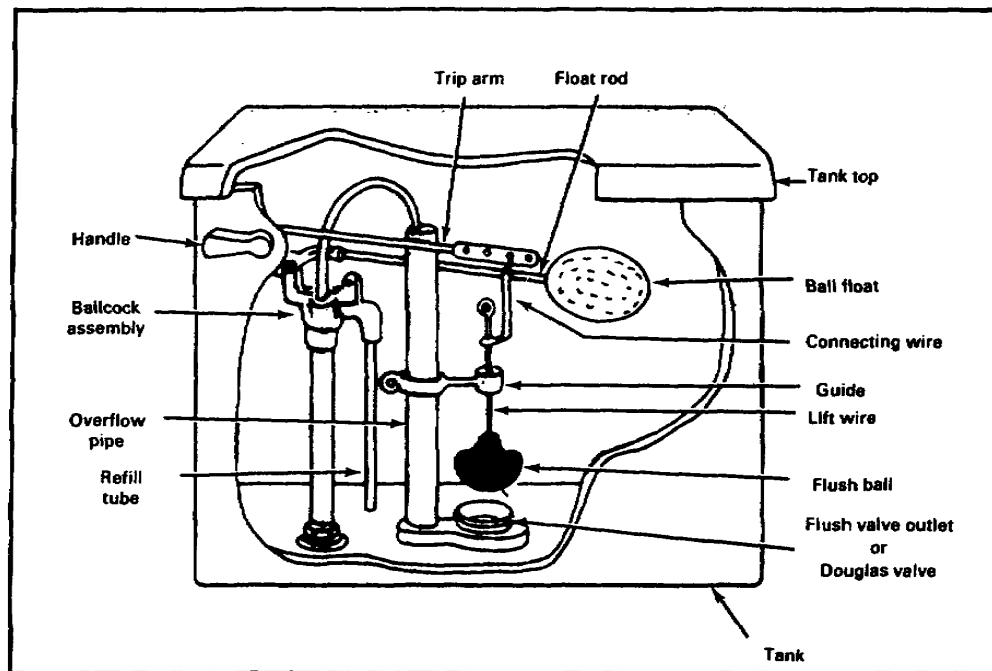
REVIEW EXERCISE SOLUTIONS

1. A. Gate
B. Globe
2. Shut off
3. Control and/or regulate
4. A. Combination
B. Single, with plain bibb
5. Packing
6. Disc
7. A. Packing
8. B. Washer
9. A. O-ring
10. Diaphragm
11. Rubber cup
12. Packing washer

Learning Event 1: REPAIRING FLUSHING MECHANISMS

Fixture control devices are used for flushing, holding water in a lavatory bowl, and draining waste. These devices-such as a water closet's tank flushing mechanism or lavatory/sink popup plug-get much usage and wear. When a fixture control device fails to operate properly or leaks, the malfunction is located and repaired. See figures 20 through 22 on pages 39 through 42.

FIGURE 20. BALLCOCK-TYPE FLUSHING MECHANISM



WATER CLOSET'S BALLCOCK TYPE FLUSHING MECHANISM MALFUNCTIONS AND REPAIRS

Malfunction	Repairs
1. Water level running into top of overflow pipe.	a. Remove tank top. b. Unscrew ball float from rod. c. Shake ball float to find out if any water is in the ball. d. If water is inside the ball, replace the ball float. If no water is in the ball, the ball float is functional.

**WATER CLOSET'S BALLCOCK-TYPE FLUSHING MECHANISM
MALFUNCTIONS AND REPAIRS (Continued)**

- e. Screw ball float back onto the rod.
 - f. Place both hands on the middle of the float rod and carefully bend the ball side of the rod down about ½ inch.
 - g. Flush water closet to check that water level is below top of overflow pipe.
 - h. Replace tank top.
- 2. Running water closet caused by —
 - a. Damaged flush ball.
 - a. Remove tank top.
 - b. Turn off water supply at shutoff valve.
 - c. Flush water closet to empty tank.
 - d. Unscrew flush ball from lift wire.
 - e. Check bottom of flush ball for damage or wear.
 - f. If flush ball is damaged or worn, replace it with a new one.
 - g. Clean flush valve outlet with emery cloth or steel wool.
 - h. Operate handle several times to check that the flush ball sits evenly in the flush outlet valve.
 - i. Turn on water supply.
 - j. Flush water closet to check repair.
 - k. Replace tank top.

WATER CLOSET'S BALLCOCK-TYPE FLUSHING MECHANISM MALFUNCTIONS AND REPAIRS (Continued)

- b. Damaged Washer.**
- a. Turn off water supply shutoff valve.**
 - b. Flush water closet to empty water from tank.**
 - c. Remove screws or pins.**
 - d. Lift plunger out of assembly.**
 - e. Check both washers for damage or wear.**
 - f. Replace worn or damaged washer.**
 - g. Reassemble ballcock assembly.**
 - h. Turn on water supply.**
 - i. Flush water closet several times to check repair.**
 - j. Replace tank top.**

FIGURE 21. BALLCOCK PARTS

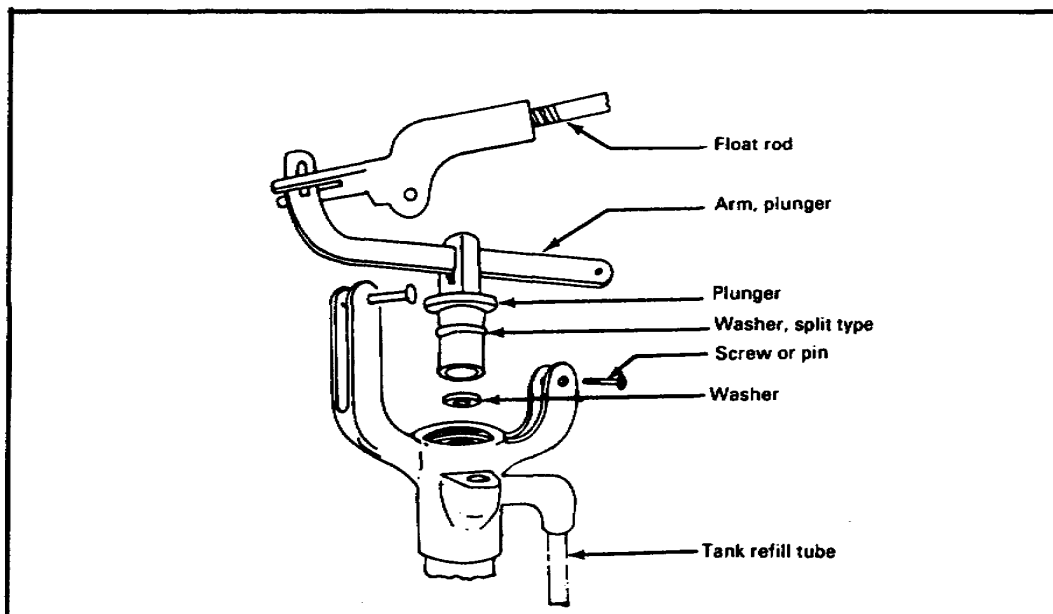
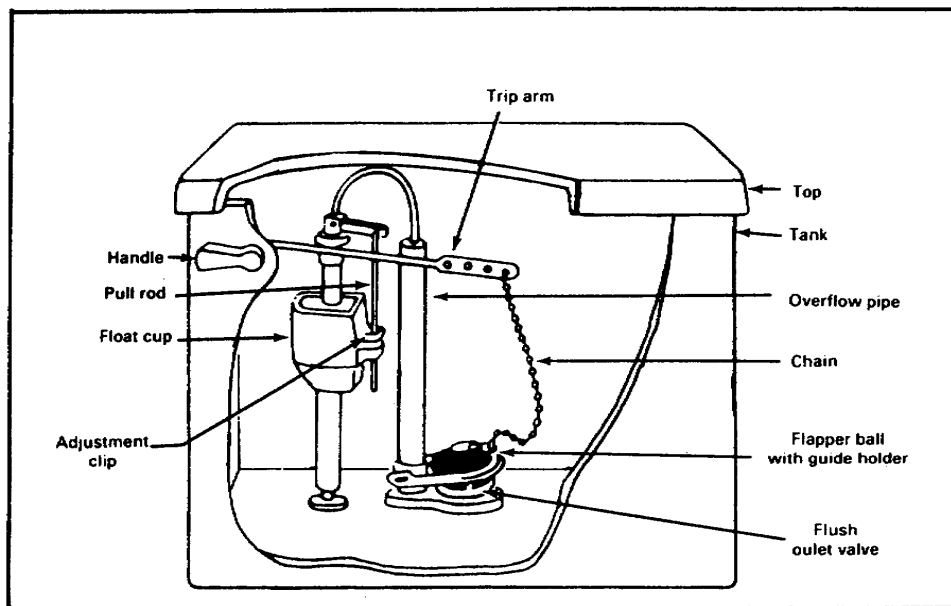


FIGURE 22. FLOAT-CUP-TYPE FLUSHING MECHANISM



FLOAT-CUP-TYPE FLUSHING MECHANISM MALFUNCTIONS AND REPAIRS

Malfunction	Repairs
1. Water level running into top of overflow pipe.	<p>a. Remove tank top.</p> <p>b. Grab the top and bottom of the adjustment clip, squeeze, and move it down on the pull rod to lower the float cup.</p> <p>c. Flush tank and check incoming water level. Level should be about one inch below top of overflow pipe.</p> <p>d. If level is not correct, repeat steps b and c above. Replace tank top.</p>
2. Running water closet.	<p>a. Remove tank top.</p> <p>b. Turn off water supply at shutoff valve.</p> <p>c. Flush water closet to empty tank.</p> <p>d. Lift up flapper ball and check for damage or wear.</p>

**FLOAT-CUP-TYPE FLUSHING MECHANISM MALFUNCTIONS
AND REPAIRS (Continued)**

- e. If flapper ball is damaged or worn, replace it.
- f. Clean outlet valve with emery cloth or steel wool.
- g. Operate handle several times to check that flapper ball sits evenly in the outlet valve.
- h. Turn on water supply.
- i. Flush water closet to check repair.
- j. Replace tank top.

SELF-CHECK EXERCISE

Solutions are on page 44.

1. A ballcock flushing mechanism has water running into the top of the overflow pipe. What part of the flushing mechanism would you check first?
 - A. Flush ball
 - B. Float rod
 - C. Trip arm
 - D. Ball float
2. You determine that the ballcock assembly is causing a running water closet. What part would you replace?
 - A. Plunger
 - B. Plunger arm
 - C. Washer
 - D. Screw or pin

Fill in the blanks with your responses.

3. Water is running into the top of the overflow pipe. The float cup is moved _____ on the pull rod to lower the water level.
4. A water closet with a float cup flushing mechanism is running. The _____ must be replaced.

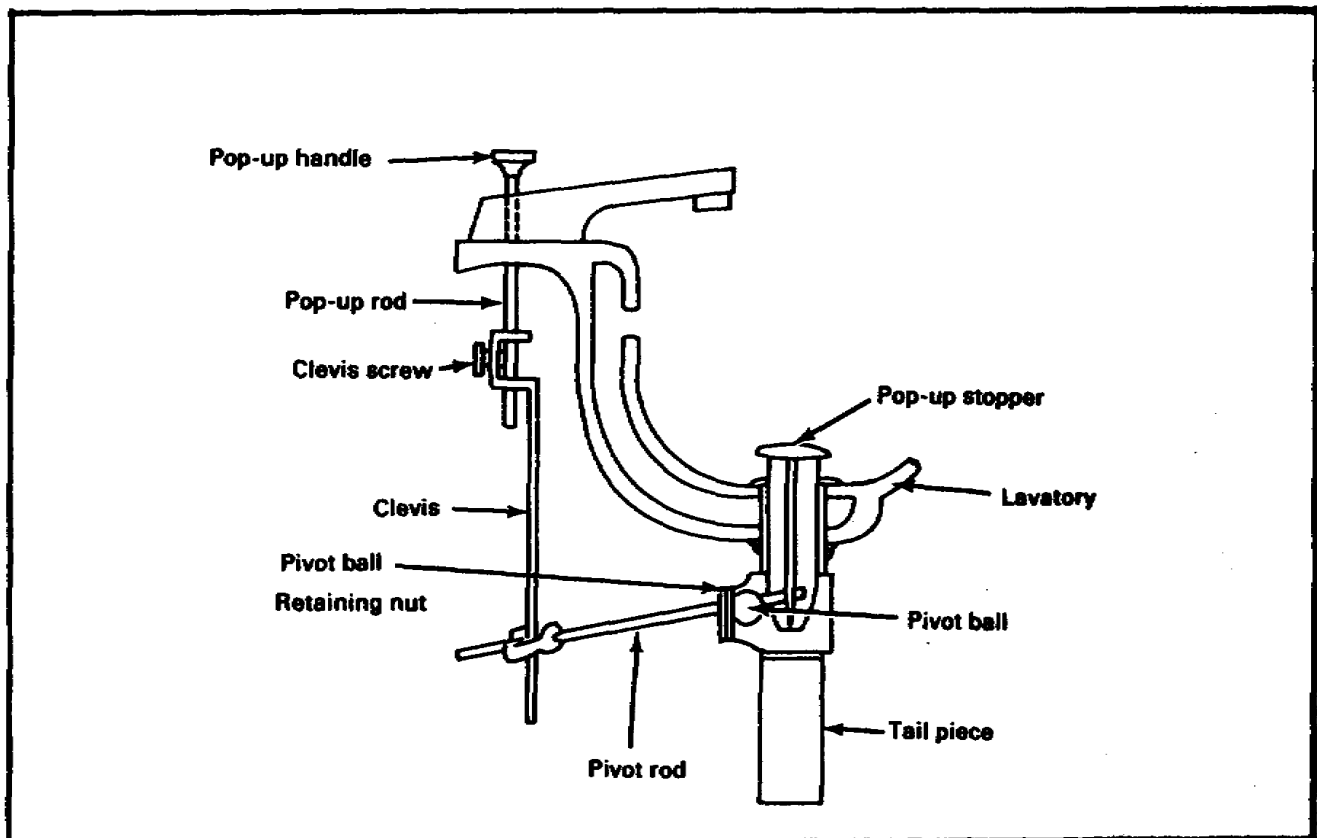
Lesson 2/Learning Event 2

Learning Event 2: REPAIRING CONTROL DEVICES

Control devices that can malfunction in a lavatory are the pop-up plug and the pivot ball connection. When the plug does not hold water in the bowl and the pivot ball connection leaks, the malfunction must be located and repaired. See figures 23 through 25 on pages 44 through 46.

NOTE: Many companies manufacture a popup type mechanism for lavatories. The working parts are generally the same, so malfunctions and repairs will be basically the same. A typical pop-up plug mechanism is shown here.

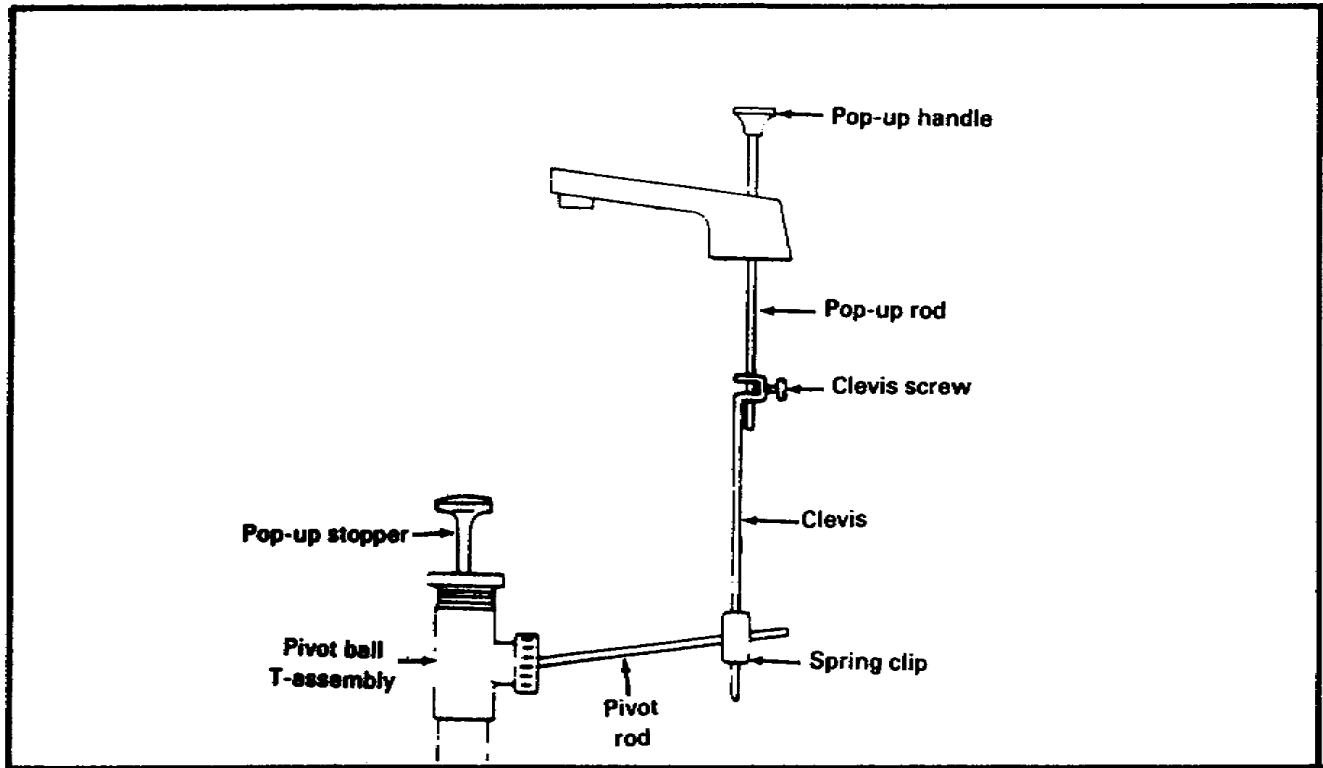
FIGURE 23. POP-UP PLUG MECHANISM



SELF-CHECK EXERCISE SOLUTIONS

1. D. Ball float
2. C. Washer
3. Down
4. Flapper ball

FIGURE 24. POP-UP PLUG PARTS



STOPPER FAILS TO KEEP WATER IN LAVATORY'S BOWL

Malfunction

Stopper fails to keep water in bowl.

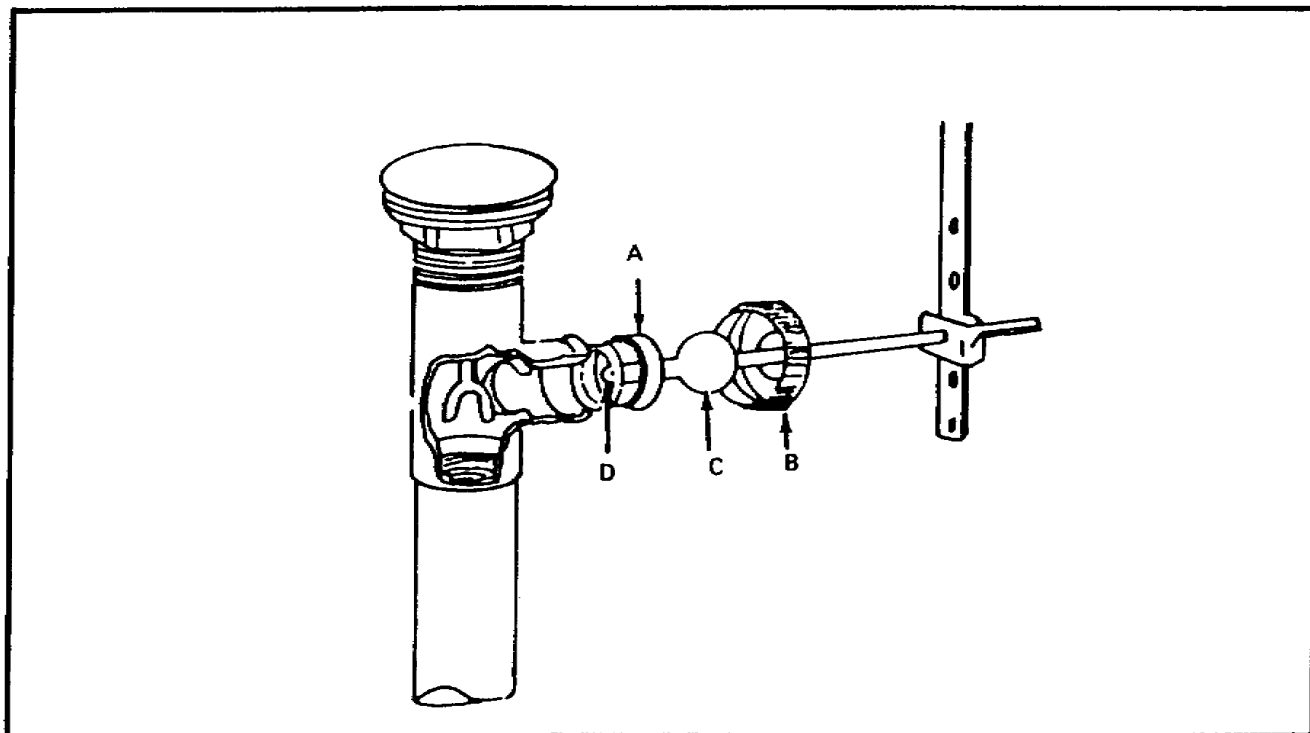
Repairs

- a. Loosen clevis screw with pliers.
- b. Push pop-up stopper down so it sits snugly on flange.
- c. Tighten clevis screw and check to make sure it fits snugly on flange.

If the stopper does not operate as easily as it should, this can be corrected as follows:

- a. Squeeze spring clip and pull out the pivot rod from the clevis hole.
- b. Place the pivot rod through the next higher or lower hole in the clevis.
- c. Close stopper and fill bowl with water.
- d. Check water level to assure the stopper holds water in the bowl.

FIGURE 25. PIVOT BALL PARTS



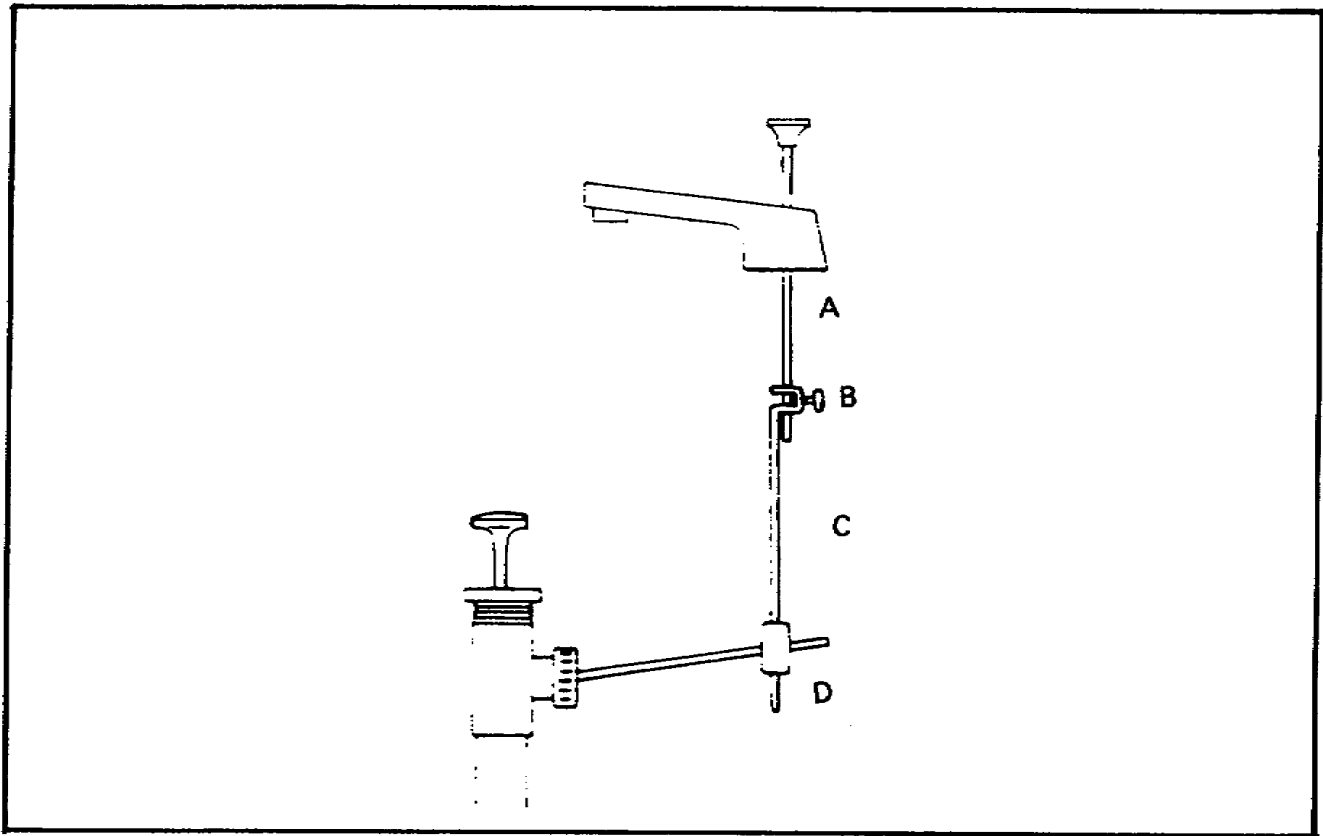
PIVOT BALL MECHANISM MALFUNCTIONS AND REPAIRS

Malfunction	Repairs
Leak at pivot ball connection.	<p>a. Tighten pivot ball retaining nut. If leak continues, remove nut with pliers.</p> <p>b. Squeeze spring clip and slide the pivot rod out of the clevis hole.</p> <p>c. Slide pivot ball retaining nut and worn washers off the pivot rod.</p> <p>d. Slide new washers, plastic and rubber, and pivot ball nut onto pivot rod.</p> <p>e. Tighten pivot ball retaining nut.</p> <p>f. Reassemble pivot rod into clevis hole.</p> <p>g. Run water into lavatory and check the connection for leaks.</p> <p>NOTE: Always check that the pop-up stopper operates properly in holding water after a repair has been made on the pivot ball connection.</p>

SELF-CHECK EXERCISE

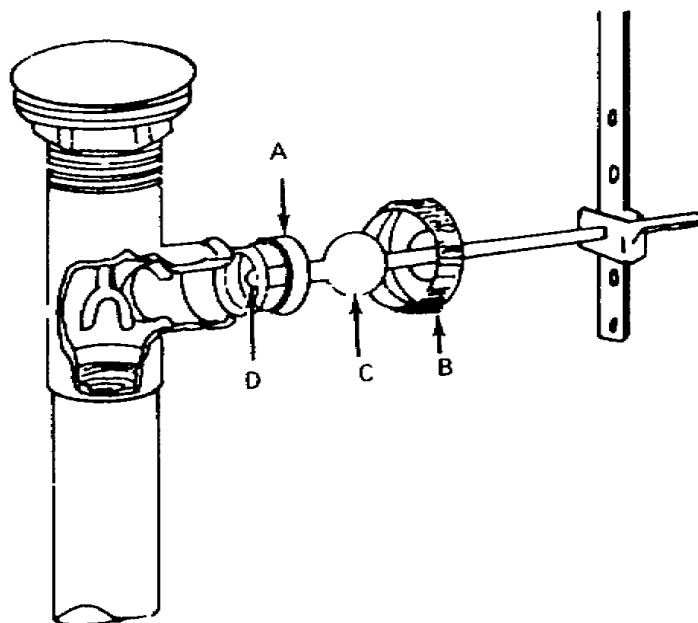
Solutions are on page 52.

1. When a lavatory's pop-up mechanism fails to hold water in the bowl, at what two points is the repair made? (See illustration.)



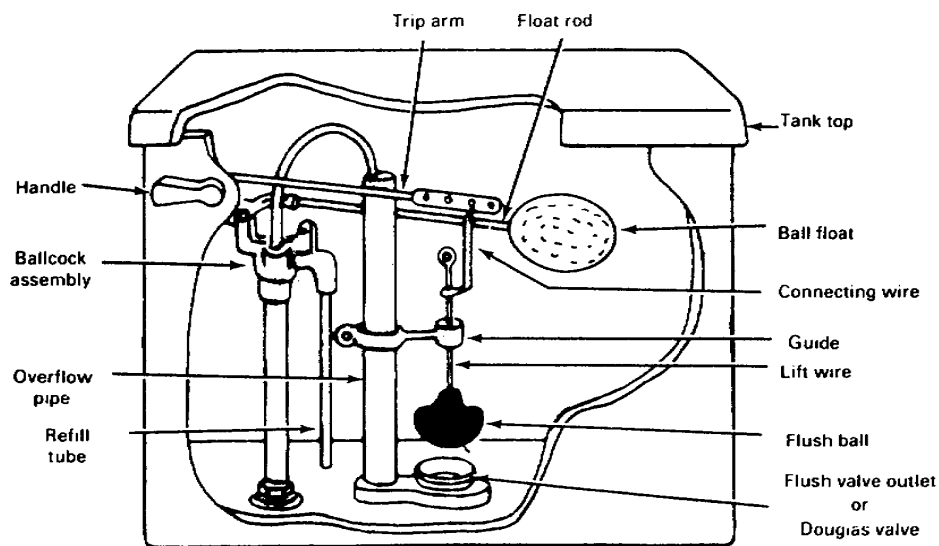
Lesson 2/Review Exercise

2. When a lavatory's pop-up mechanism is leaking at the retaining nut, what parts are replaced to make the repair? (See illustration.)



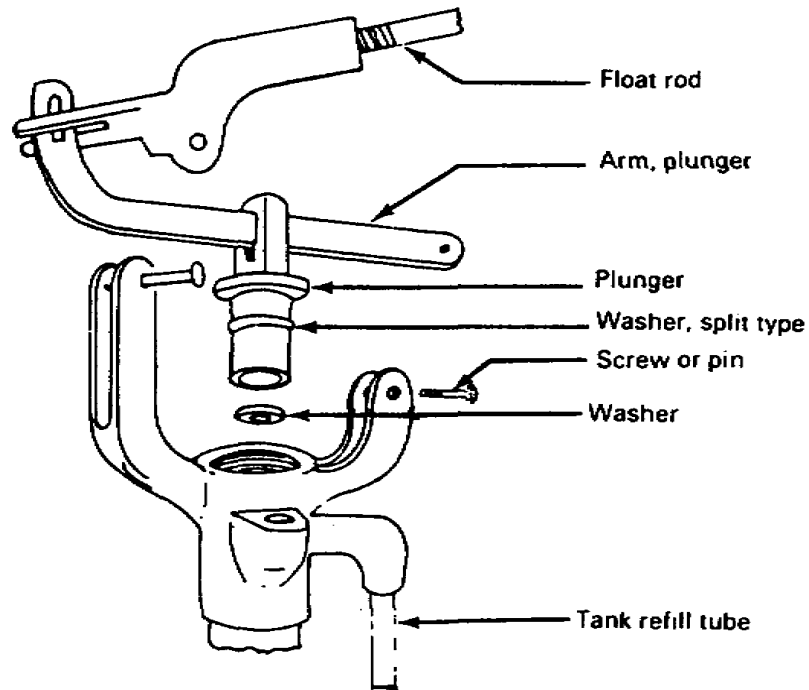
Lesson 2 REVIEW EXERCISE

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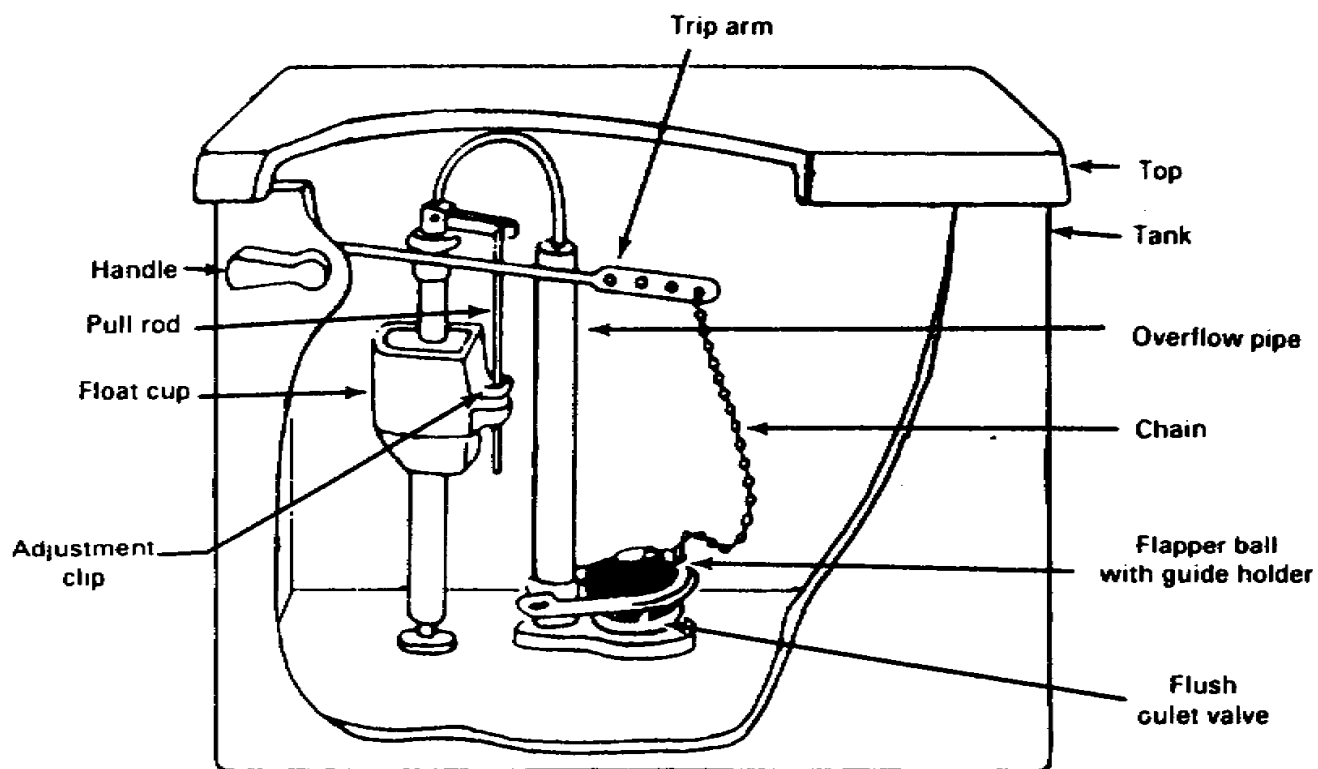
Lesson 2/Review Exercise

1. The water level is running into the top of the overflow pipe. What part would you remove and check to determine the cause? _____
2. When a water closet runs, what part must you replace? _____
3. A running water closet is caused by a malfunction in the ballcock assembly. Disassembling the ballcock you determine that two parts must be replaced. What are the two parts? _____



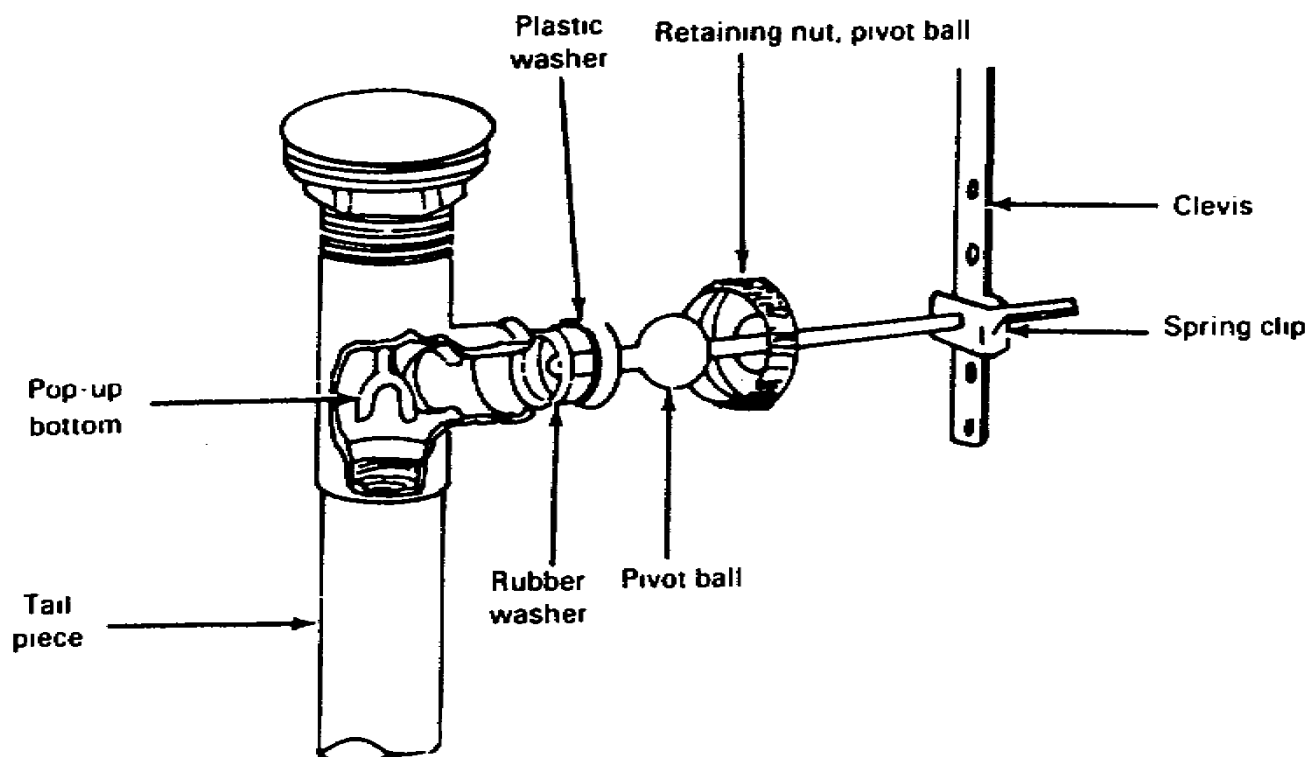
Lesson 2/Review Exercise

4. Water is running into the top of the overflow pipe in a water closet. What part would you adjust to lower the water level? _____



Lesson 2/Review Exercise

5. The pop-up stopper mechanism is leaking at the retaining nut. What two parts would you replace to repair the leak? _____



Lesson 2/Review Exercise

SELF-CHECK EXERCISE SOLUTIONS

1. B and D
2. A and D

REVIEW EXERCISE SOLUTIONS

1. Float ball
2. Flush ball
3. Split type washer and washer
4. Float cup
5. Rubber washer and plastic washer